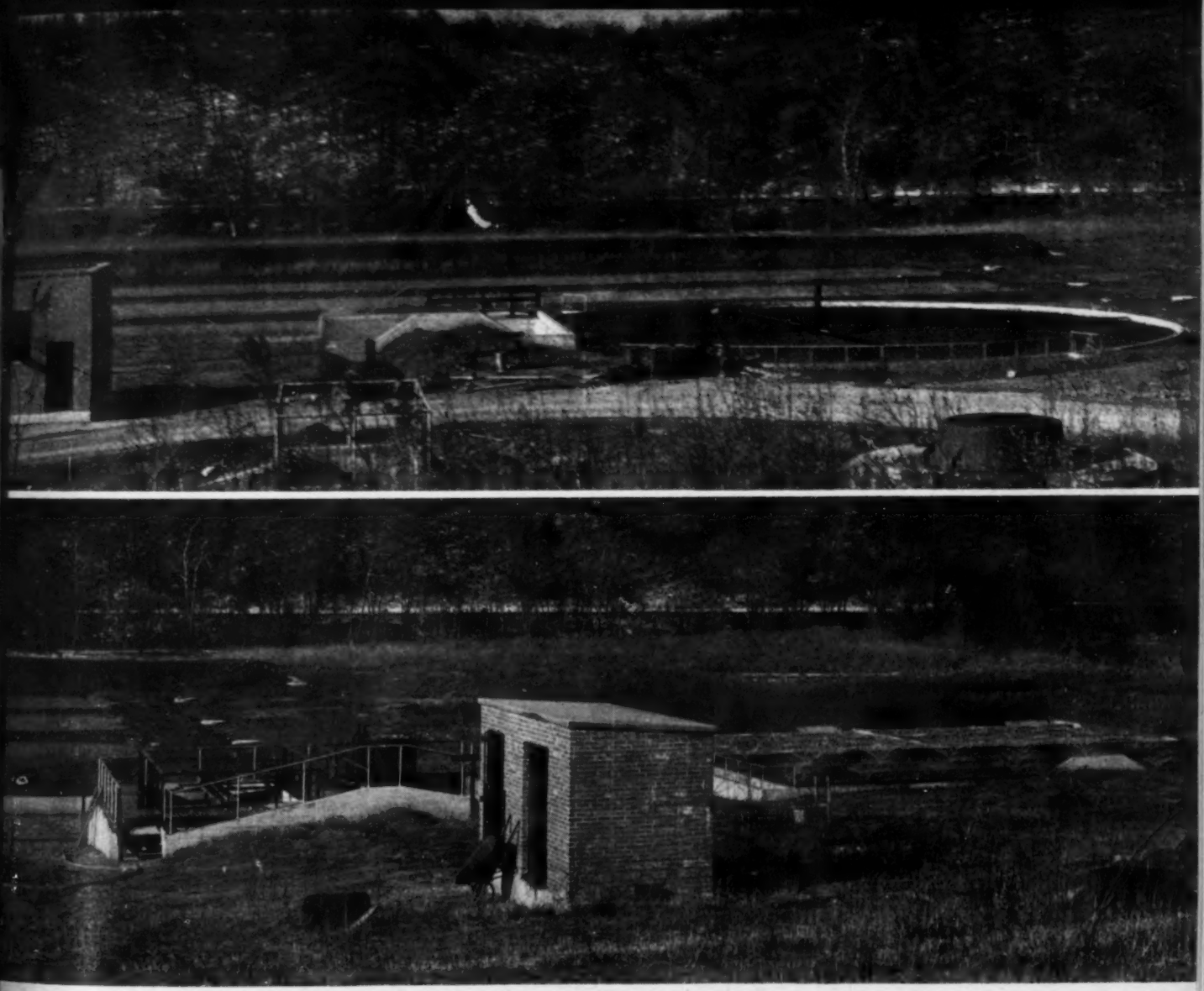
WATER WORKS & SEWERAGE

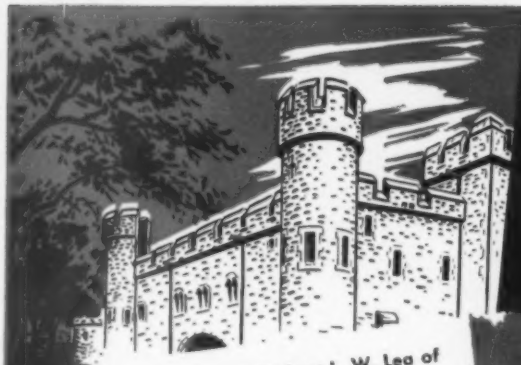


INTEGRATED INDUSTRIAL WASTE AND SEWAGE TREATMENT PLANTS
AMERICAN VISCOSE CORP.—FRONT ROYAL, VA.

Penn Salt men in the service meet a Penn Salt product in the service...

Perchloron

REG. U.S. PAT. OFF.



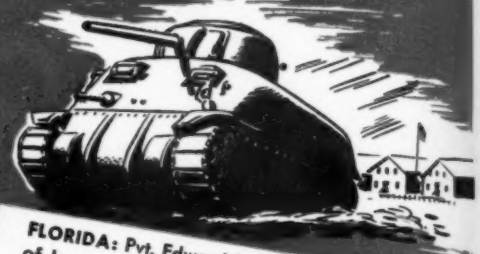
ENGLAND: Lt. Sydney L. W. Lea of Sales found Perchloron serving in a foot bath.

U. S. A.: Sgt. Arthur F. Bixby of Heavy Chemical Sales found Perchloron in use at two camps in different states.

SOUTH ATLANTIC: George J. Craig, Jr., SK 3/c of Accounting, found Perchloron serving advance naval bases.

U. S. A.: Captain Charles B. Griffin, Jr., of Technical Service found Perchloron serving several different camps and arsenals.

AUSTRALIA, NEW GUINEA: Major George D. Grogan of Heavy Chemical Sales found Perchloron used for various sanitizing purposes.



FLORIDA: Pvt. Edward F. Smith, Jr., of Laundry & Dry Cleaning, found Perchloron in use in mess halls, kitchens, foot baths.

OKLAHOMA: S/Sgt. T. Bayard Grace of Purchasing found Perchloron on duty.

In camp kitchens, laundries, shower rooms, foot baths, Perchloron is doing important work...sanitizing the water supply for the army and navy.

Perchloron is again available for civilian use...in limited quantities. You can depend on it to serve your water sanitation problem as effectively as it serves the armed forces. Call on a Penn Salt representative for advice and co-operation without obligation. Write today for *free* Perchloron booklet to Dept. WWS.

PENNSYLVANIA SALT MANUFACTURING COMPANY

Chemicals

1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

New York • Chicago • St. Louis • Pittsburgh • Minneapolis • Wyandotte • Tacoma

Penn Salt manufactures

LIQUID CHLORINE

for water sanitation and sewage treatment

Also Anhydrous Ammonia • Filter Alum • Ferric Chloride • Sodium Aluminate • Chloride of Lime • Caustic Soda and other products

WATER WORKS & SEWERAGE, August, 1944, Volume 91, Number 8. Published monthly by Gillette Publishing Co., 330 South Wells Street, Chicago, Ill. Per copy, 25c. Subscription rate, United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under act of March 3, 1879.

WELCOME BACK Empire STREEEMLINE BRONZE CASE METERS

Amendment to W. P. B. Order L-154 Permits Resuming Manufacture of these Superior Bronze Case Meters.

YES, Empire Streeemline Meters are again in production—welcome news to the many water meter buyers who preferred to defer purchases until bronze cases could be made available. And, these—the most modern of today's meters—embody even more refinements than their pre-war predecessors. For we have learned, as we have worked for Victory, new ways to make better meters.

Empire Streeemline Meters are of the oscillating piston type—a design principle that over a 60 year span has earned an enviable reputation among water works' men for extreme accuracy, long life, and low cost of maintenance. In the Streeemline, scientifically proportioned measuring chambers extract the ultimate in precision from perfectly balanced pistons. Smooth interior flow contours and measuring chambers with dual inlet and outlet ports keep pressure absorption at the absolute minimum. Balance and careful fitting reduce friction and wear, assuring retention of the high initial accuracy, over a long period of time.

Now A Complete Domestic Line

Our engineers have expanded the EMPIRE Streeemline design, during the war interlude, to provide complete coverage of all domestic requirements. We are now in production on all sizes from ⅝ inch through 1 inch and can make prompt deliveries on orders received. Revised literature on the complete line of EMPIRE Streeemline Meters is now available and will be sent upon request.

AVAILABLE NOW!

IN SIZES ⅝ INCH THRU 1 INCH

PITTSBURGH EQUITABLE METER CO.

Atlanta Boston Brooklyn Buffalo Chicago Columbia Houston Kansas City Los Angeles New York Pittsburgh San Francisco Seattle Tulsa

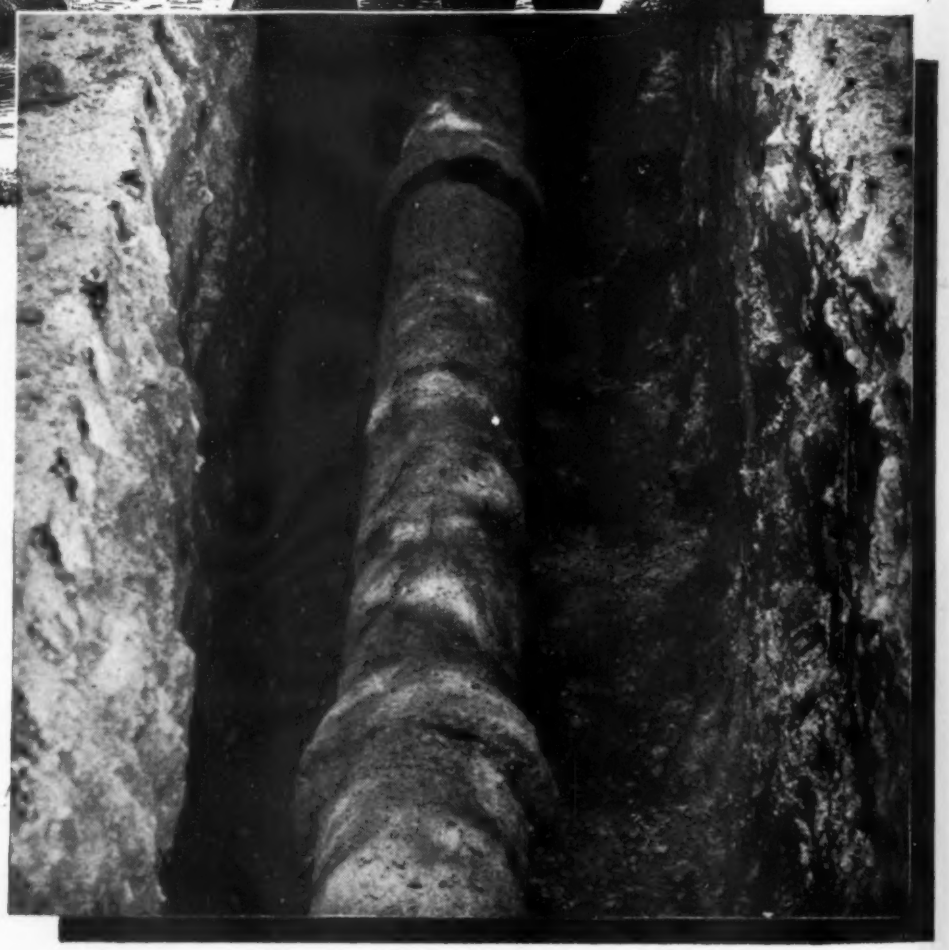
MERCO NORDSTROM VALVE CO.

Main Offices, PITTSBURGH, PA.

National Meter Division, Brooklyn, N. Y.

Water Meters

22



On October 9th, 1858, the first overland mail via pony express arrived at St. Louis, Mo. 23 days and 4 hours from San Francisco. In 1836, 22 years earlier, Lancaster, Pa. laid a cast iron water main. It is still in service. Unretouched photograph at right shows a section of this main uncovered for inspection in 1941.

108 YEARS OF CONTINUOUS SERVICE IN LANCASTER, PA.

CAST IRON PIPE

years before the Pony Express....

a cast iron water main was laid in Lancaster, Pa. and is STILL SERVING

One of several cast iron mains in *New York City* more than a century old.

America's oldest iron main now in its 123rd year of service in *Philadelphia.*

A CENTURY of service is difficult to realize except in relation to historical events. The three cast iron mains shown on these pages are from 108 to 122 years old. All of them were laid before this country had a railroad, or steam navigation, or the telegraph or the romantic pony express. They are still in service—and doubtless will be a hundred years hence, in their present locations or elsewhere. The unretouched photographs, at left, show these more-than-century-old cast iron mains in service in the ground, temporarily uncovered for inspection.

Cast iron pipe is the only pressure pipe with a history of more than a century of useful life. In Europe, authenticated records of cast iron mains in continuous service for more than two centuries are not exceptional. These long-life records were established by pipe made by rule-of-thumb methods of olden time. Today's cast iron pipe is produced by scientific methods, developed by years of field and foundry research, and with laboratory controls at every step from raw materials to finished pipe.

CAST IRON PIPE RESEARCH ASSOCIATION
Thomas F. Wolfe, Research Engineer, Peoples Gas Building, Chicago 3

Serves for Centuries

Serious scale problem in Wichita stopped by Calgon*

—*Water superintendent Rogers proves it himself!*

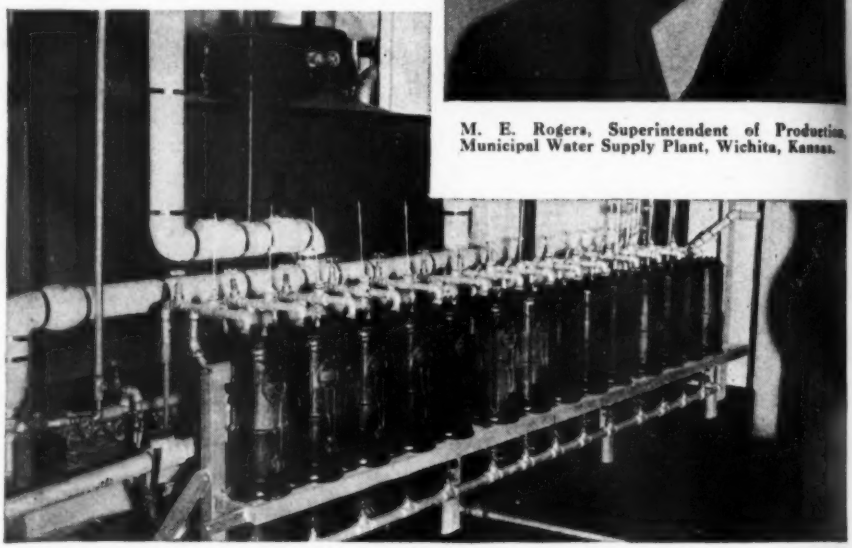
M. E. Rogers, Superintendent of Production, Municipal Water Supply Plant, Wichita, Kansas.

WHEN Wichita's new water plant went into service a few years ago, they encountered serious trouble with scale formation. In some restaurants where large volumes of water were heated to high temperatures, heater coils would fill with scale within a few weeks. In homes, several hundred coils a month were being lost.

Mr. Rogers, superintendent, set out to stop this trouble as fast as possible. He started to feed 2 ppm. Calgon. Results were apparent throughout the system within two days. Within a week alkalinity drops through heaters at various sampling points had stopped.

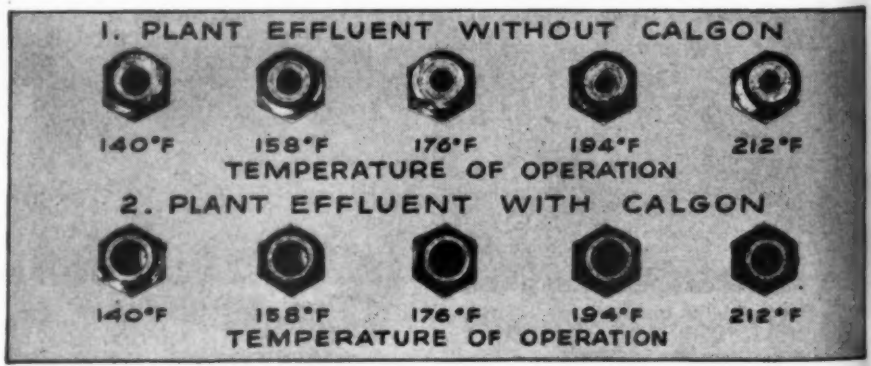
Mr. Rogers then decided to find out just how good Calgon was and how much was required to do the job. He set up 15 water heaters in his plant and ran them continuously for two years. Experiments carried out with the assistance of the local Master Plumbers Association over this period of two years at various temperatures and Calgon concentrations showed that a feed of only ½ ppm. of Calgon at the plant was required to insure the people of Wichita against scale formation in their hot water heater coils and pipes.

In Wichita, and hundreds of other cities, the effectiveness of Calgon has been proved. Don't take our word for it, or even Mr. Rogers'. Make your own tests on your own water and see for yourself how much can be accomplished in scale prevention and corrosion control with only a small amount of Calgon.



(above)
Hot water heater assembly for experiments which showed that Calgon treatment prevented scale in amounts as low as ¼ ppm.

(below)
Cross sections of test coils show effectiveness of Calgon in preventing scale at various temperatures.
1. Plant effluent without Calgon.
2. Plant effluent with Calgon.



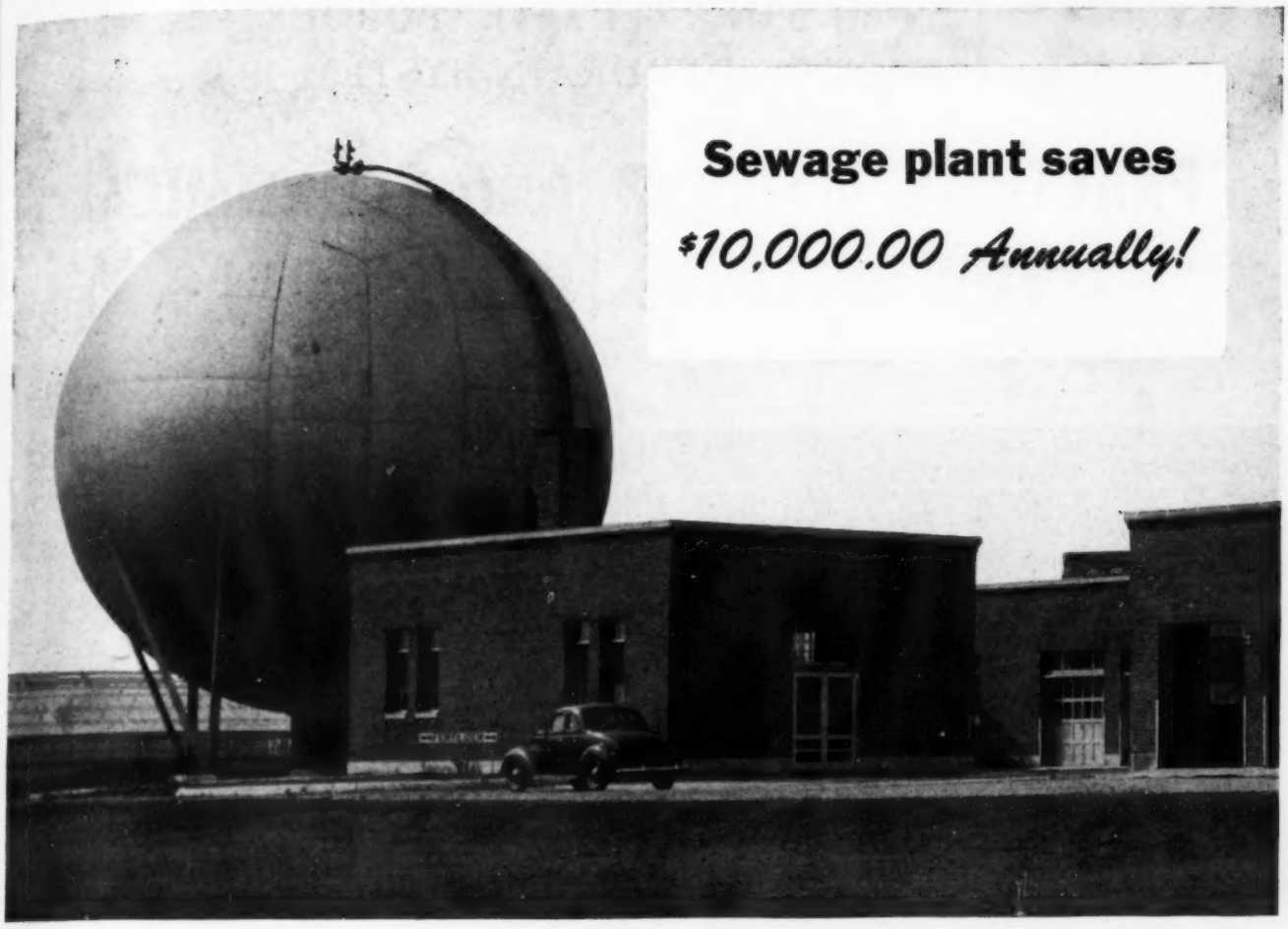
HAGAN
HALL
BUROMIN
CALGON

calgon, inc.

A SUBSIDIARY OF
HAGAN CORPORATION

HAGAN BUILDING
PITTSBURGH 30, PA.

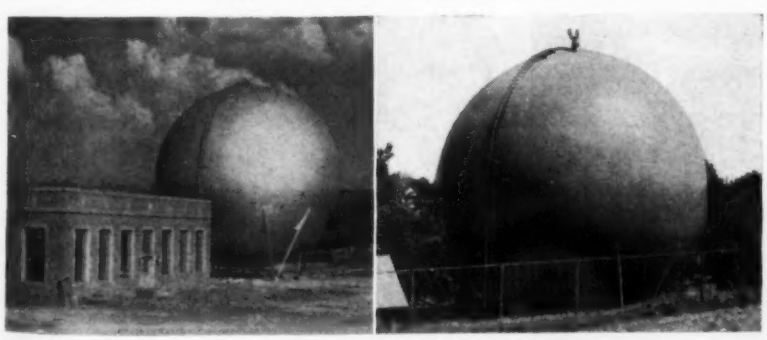
**Calgon is the registered trade-mark of Calgon, Inc., for its glassy sodium phosphate products.*



...with the aid of a HORTONSPHERE

By utilizing sewage gas in the two sludge gas engines which generate power for the operation of the sewage treatment plant, the Green Bay, Wisconsin, Metropolitan Sewage District was able to realize a net profit or savings of $63,628.00 over a period of six years on an original investment of approximately $29,000.00. The 50-ft. Hortonsphere shown above is used to store the sewage gas for use in the engines when the demand for fuel exceeds the amount being produced in the digesters. This eliminates the need of expensive standby equipment or the use of purchased fuel.

By providing storage facilities for gas produced in digesters, Hortonspheres are enabling many sewage disposal plants to heat their own buildings, incinerate sludge, heat the sludge in digestion tanks, or generate power for pumping sewage, operating blowers and lighting, thereby helping to conserve vitally needed natural and manufactured fuel gas.



The Hortonsphere shown at the extreme left, one of two located at Cleveland's sewage disposal plants, holds 200,000 cu. ft. . . . the other has a capacity of 50,000 cu. ft.

The Hortonsphere shown at the immediate left is located at the Omaha, Neb., sewage disposal plant. It is 52 ft. in diam. and operates at 64 lbs. per sq. in.

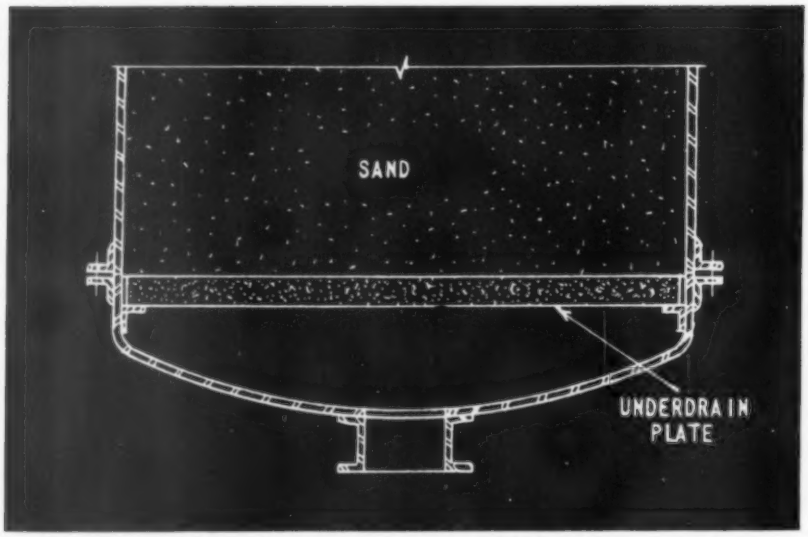
CHICAGO BRIDGE & IRON COMPANY

Chicago 4.....2198 McCormick Bldg.
New York 6.....3390-165 Broadway Bldg.
Cleveland 15.....2262 Guildhall Bldg.
Havana.....402 Edificio Abreu
Birmingham 1.....1586 North 50th Street
Plants in Birmingham, Chicago and Greenville, Pennsylvania

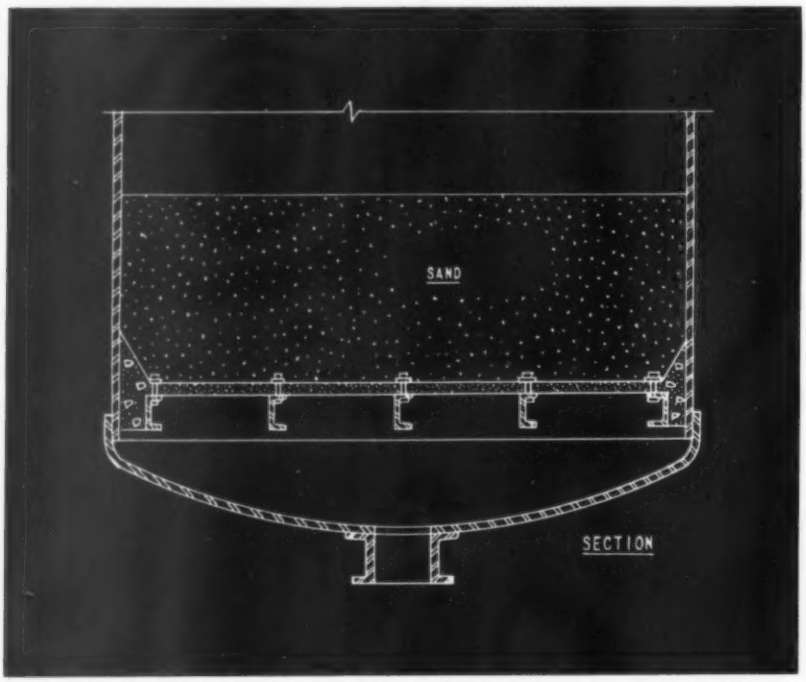
Tulsa 3.....1646 Hunt Bldg.
Houston 1.....5615 Clinton Drive
Philadelphia 3.....1644-1700 Walnut Street
Washington 5.....330 Bowen Bldg.
San Francisco 5.....1083 Rialto Bldg.
In Canada: Horton Steel Works, Limited, Fort Erie, Ont.

YES! THE "ALOXITE" POROUS UNDERDRAIN SYSTEM IS . . .

PRACTICAL, EFFICIENT AND ECONOMICAL FOR PRESSURE FILTERS, TOO!



Section of Typical Small Diameter Pressure Filter Utilizing a Single Plain Circular Underdrain Plate.



Typical Large Diameter Pressure Filter Utilizing Standard and Special Plain Underdrain Plates.

- No gravel to become "upsidedown" through excessive or non-uniform wash.
- Reduced cost of steel shell and some piping due to decreased height.
- Less washing due to better uniformity.
- Reduced pressure losses—both filtering and backwashing.

* * *

THESE and other benefits are realized in both small and large filters. Among the "more than 100" installations of "Aloxite" Underdrain plates are some pressure units ranging from 12″ to 9′ in diameter.

Write us for further information. The Carborundum Company, Refractories Division, Perth Amboy, N. J.

* * *

(Carborundum and Aloxite are registered trade marks of and indicate manufacture by The Carborundum Company)

Porous Products by CARBORUNDUM TRADE MARK

RIGHT DRESS ...FOR TOMORROW

When Johnny and his buddies come marching home, it's up to every community to have plenty of big jobs for their own men to do. One sound way to insure the future of your local citizens is to plan important public works projects NOW—projects which will give your men the steady employment they'll need during the period of "war-to-peace conversion."

The manufacture and installation of Lock Joint Concrete Pipe for your water supply lines, sewerage and drainage programs provide one of the best methods for putting your local men to work quickly—right in your own home town. Past experiences have proven that by erecting temporary local plants as much as 90% of your local labor can be used in building these dependable and economical pipelines. In addition, the Lock Joint Pipe Company buys the bulk of supplies and materials from your own merchants—and thus, most of the cost of the project remains in your community.

Whether your project is large or small, for the present or the future, your 'phone call, telegram, cable or letter to any of our offices will bring a prompt reply.

LOCK JOINT Reinforced Concrete PRESSURE PIPE

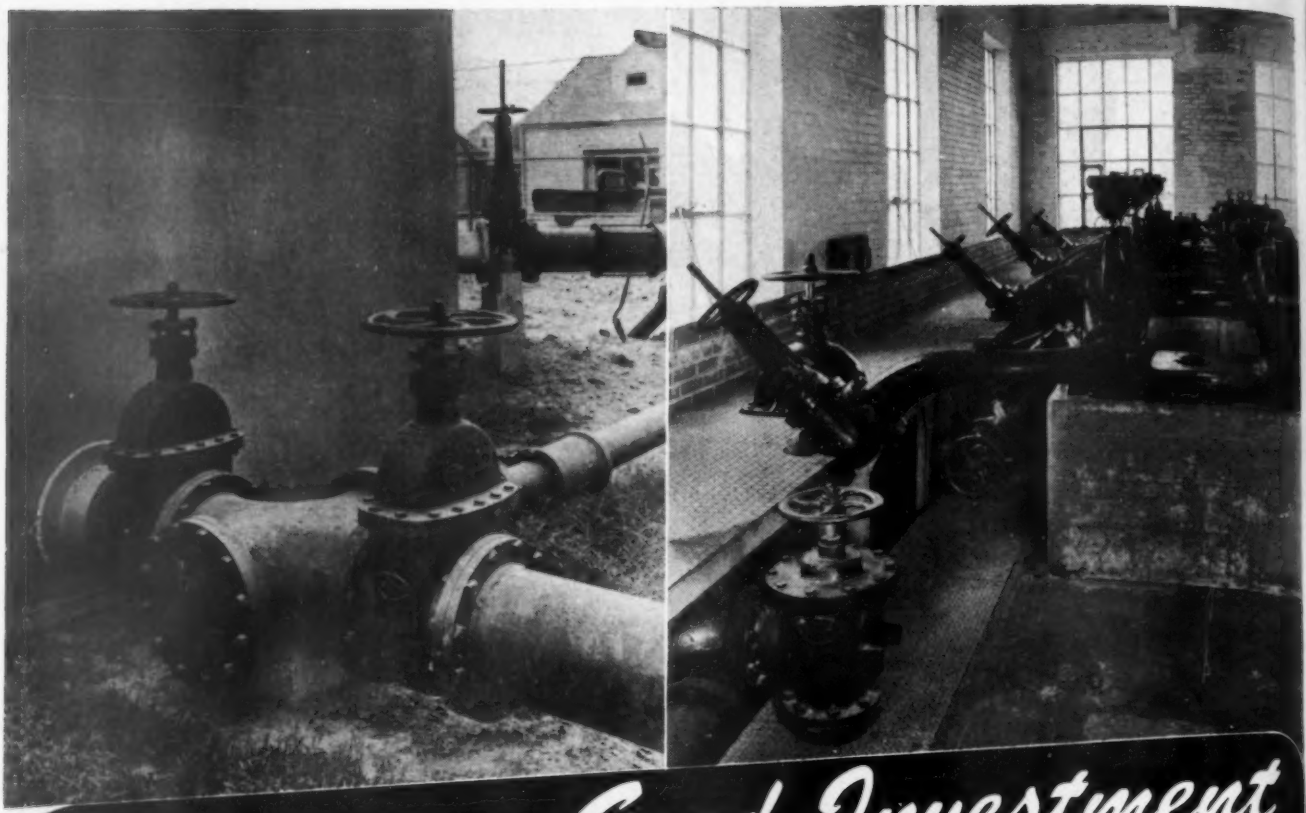
LOCK JOINT PIPE COMPANY

Established 1905

AMPERE, NEW JERSEY

Denver, Colo. • Chicago, Ill. • Kenilworth, N. J. • Kansas City, Mo. • Rock Island, Ill. Joplin, Mo. • Valley Park, Mo. • Cleveland, Ohio • Hartford, Conn. • Navarre, Ohio

SCOPE OF SERVICES *Lock Joint Pipe Company specializes in the manufacture and installation of Reinforced Concrete Pressure Pipe for Water Supply Mains as well as Concrete Pipe of all types for Sanitary Sewers, Storm Drains, Culverts and Subaqueous lines.*



TAKE A LOOK AT A *Good Investment*

The above views of Ludlow Valve installations in the municipal water works at West University Place, Texas, illustrate a well-laid foundation for public approval.

Now, when we can look forward confidently to the increased relaxing of restrictions, is the time to make definite plans for needed improvements and additions to water systems. Ludlow Valves and Hydrants—long-lived, dependable—pay off in satisfaction and security—dividends worth getting for *your* community.

W-1

Ludlow List 44. Flanged, Double Disc Gate Valve with OS&Y. Iron body, bronze mounted. Cold working pressure, 200 lbs. Test pressure 350 lbs. Can be repaired in the field much easier than the wedge-type gate valve.

LUDLOW VALVES and HYDRANTS

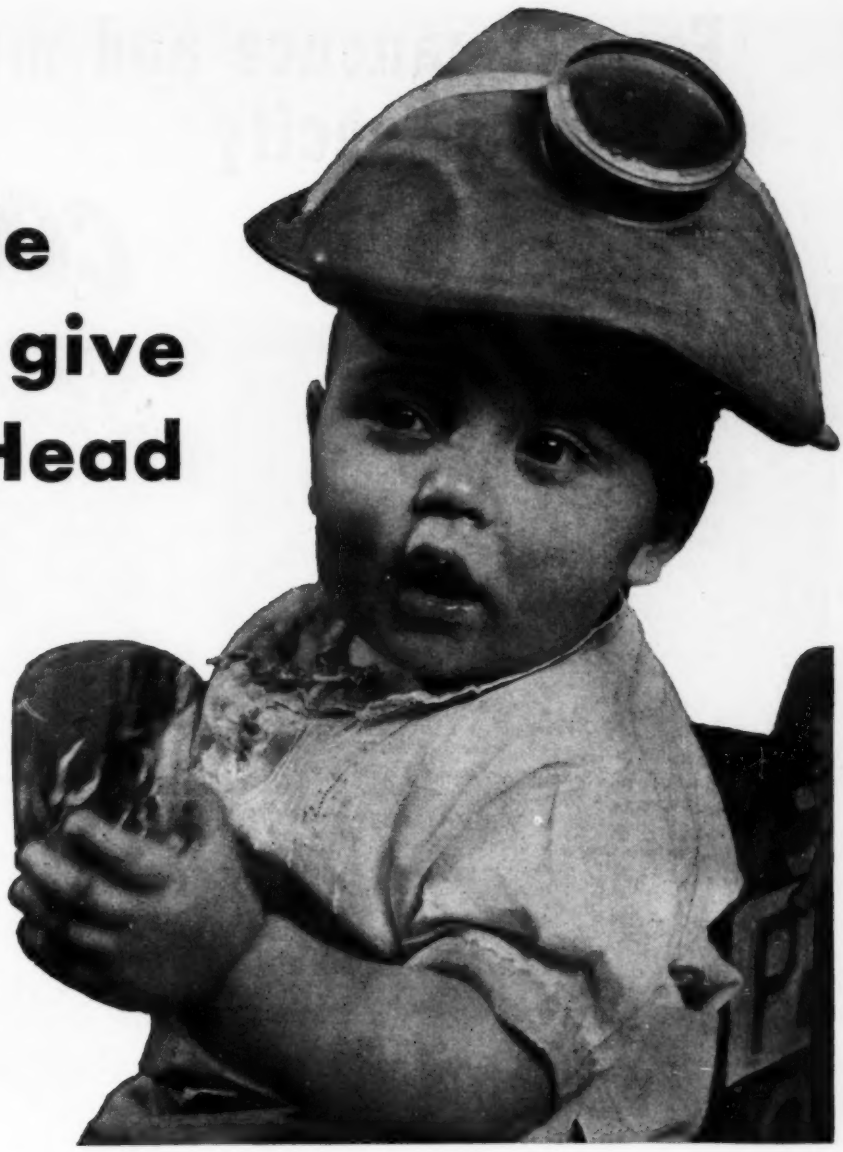
Catalogs sent on request. And we'll be glad at any time to aid you in planning water supply installations. No obligation.

The **LUDLOW VALVE**

SINCE 1866

MFG·CO·INC·TROY·N·Y·

Unpalatable Water can give You a Big Head too!



Yes, trouble usually comes in big bunches and unpleasant tastes and odors in your raw water supply can develop overnight. That is why you should keep on hand an adequate supply of Aqua Nuchar Activated Carbon.

Aqua Nuchar has demonstrated conclusively to over 1,200 water suppliers throughout the country that its use is the most effective method of eliminating taste and odor from water.

If you want to be certain of peak efficiency in your plant, specify Aqua Nuchar Activated Carbon. It is your guarantee of a sparkling and palatable water. There are strategically located stocks of Aqua Nuchar Activated Carbon convenient to important consuming centers to service customers requiring less than carload deliveries. These warehouse stock points form a nation-wide network which assures local delivery service in virtually every part of the United States and Canada. Aqua Nuchar is manufactured in three plants—namely, Covington, Virginia; Piedmont, West Virginia; and Tyrone, Pennsylvania, from whence all carload shipments are made.

BLUEPRINT NOW!

But above all, remember there is a war yet to be won.
Maintain equipment to assure operation at 100% efficiency.

NUCHAR

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP & PAPER COMPANY

230 PARK AVENUE, NEW YORK 17, N.Y. | 35 E. WACKER DRIVE, CHICAGO 1, ILLINOIS | 748 PUBLIC LEDGER BLDG., PHILADELPHIA 6, PA. | 844 LEADER BLDG., CLEVELAND 14, OHIO

For permanence and maximum strength specify.....

CONCRETE SEWER PIPE

• In June, 1944, a 24-in. reinforced concrete pipe sanitary sewer was built under this drainage canal by the Sewerage and Water Board of New Orleans. During construction the dry weather flow of the canal was by-passed in a wooden flume. The reinforced concrete pipe line was constructed in a cut to invert of 16.5 ft., approximately 10 ft. below the canal.

Concrete sewer pipe and reinforced concrete sewer pipe have been used to build sanitary sewers and storm drains in New Orleans, Louisiana, for more than 20 years. Because soil and foundation conditions are so treacherous in that city the pipe must have maximum strength and durability.

Concrete pipe serves at lowest annual cost for these reasons:

Durability proved by long years of service.
Adequate strength, structural safety.
Maximum hydraulic capacity.
Moderate first cost, ease of placement.

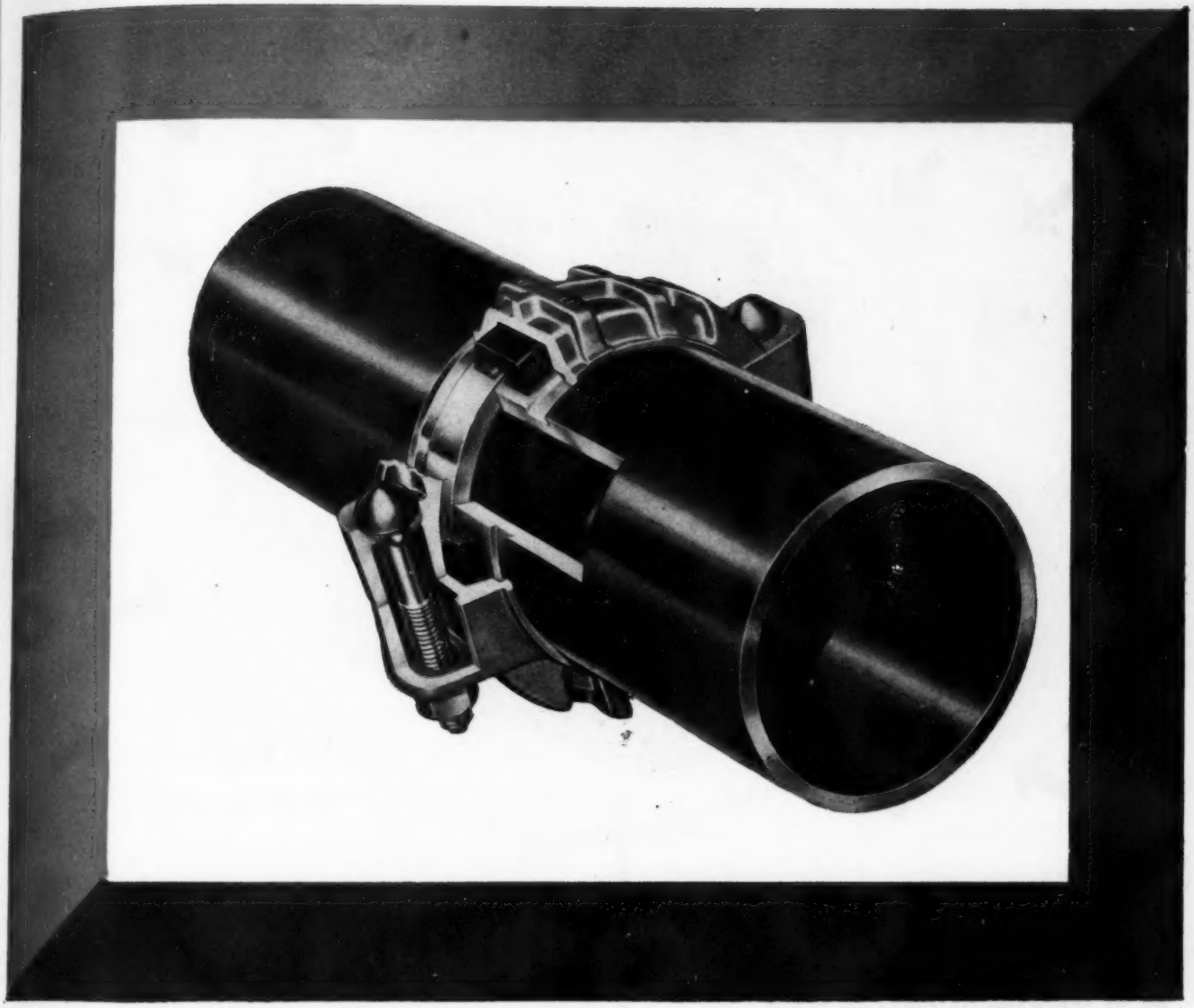
When you design sewerage improvements now and in the postwar period, specify concrete sewer pipe and reinforced concrete sewer pipe manufactured by our members (list furnished on request) to meet the test provisions of the standard specifications of the American Society for Testing Materials.

• View of the 24-in. reinforced concrete pipe sewer constructed into and out of manhole.

• Each pipe was accurately set to established line and grade and the joints carefully made and inspected to minimize leakage and infiltration. The smooth interior surface of concrete pipe provides maximum hydraulic capacity.

AMERICAN CONCRETE PIPE ASSOCIATION

33 West Grand Avenue, Chicago 10, Illinois • 342 Munsey Building, Washington 4, D.C.



This is THE Victaulic Coupling...

Here is the simplest... most versatile ALL PURPOSE pipe coupling on the market today... *in fact, of all time.* You can use the genuine Victaulic Coupling on standard steel pipe... wrought iron pipe... cast iron pipe... You can use it instead of threaded, flanged, welded, leaded and other types of pipe joining.

Proof of its versatility? You will find the rugged Victaulic Coupling "*the*" coupling in Oil, Mining, Shipbuilding, Municipal and other industrial fields... not only in the United States but also on all our fighting fronts.

Write for your free copy of the new color-illustrated Victaulic Coupling Catalog and Engineering manual. This catalog gives details of Victaulic pipe couplings, elbows, tees, reducers, caps, laterals, crosses, nipples and accessories for installation and operation of oil, gas, water, air, chemical and other types of pipe lines. Address VICTAULIC COMPANY OF AMERICA, 30 Rockefeller Plaza, New York 20, N. Y. Other Victaulic offices—Victaulic Inc., 727 West 7th St., Los Angeles 14, California; Victaulic Co. of Canada, Ltd., 200 Bay St., Toronto.

VICTAULIC

Reg. U. S. Pat. Off.

SELF-ALIGNING PIPE COUPLINGS AND FULL FLOW FITTINGS

Copyright 1944 by Victaulic Co. of America

OIL MINING MARINE MUNICIPAL INDUSTRIAL

CONCENTRATED SANITATION!

70% available chlorine in this mobile chlorine carrier

Ready for any emergency, Mathieson Sanitation HTH swiftly destroys bacteria, objectionable odors and other contamination. Dry and free-flowing, HTH is easy and economical to use. It provides the chlorine needed to safeguard health and prevent the menace of water-borne disease.

Always keep Sanitation HTH on hand. It's proven ideal not only for emergencies, but for regular treatment of water supplies and sewage effluents, and for sterilizing new watermains. HTH is very useful and effective in swimming pool sanitation, as well.

A valuable 80-page handbook "Hypo-Chlorination of Water" has been prepared especially to help you. Write for a copy now. It's yours for the asking.

Mathieson
CHEMICALS

THE MATHIESON ALKALI WORKS (INC.) 60 EAST 42nd STREET, NEW YORK 17, N. Y.

SANITATION HTH..LIQUID CHLORINE..PH-PLUS..FUSED ALKALI..CAUSTIC SODA..SODA ASH..BICARBONATE OF SODA..BLEACHING POWDER
AMMONIA, ANHYDROUS & AQUA..DRY ICE..CARBONIC GAS..SYNTHETIC SALT CAKE..SODIUM CHLORITE PRODUCTS..SODIUM METHYLATE

THE EXACTING PRECISION OF WARTIME PRODUCTION PROMISES EVEN FINER *BADGER WATER METERS!*

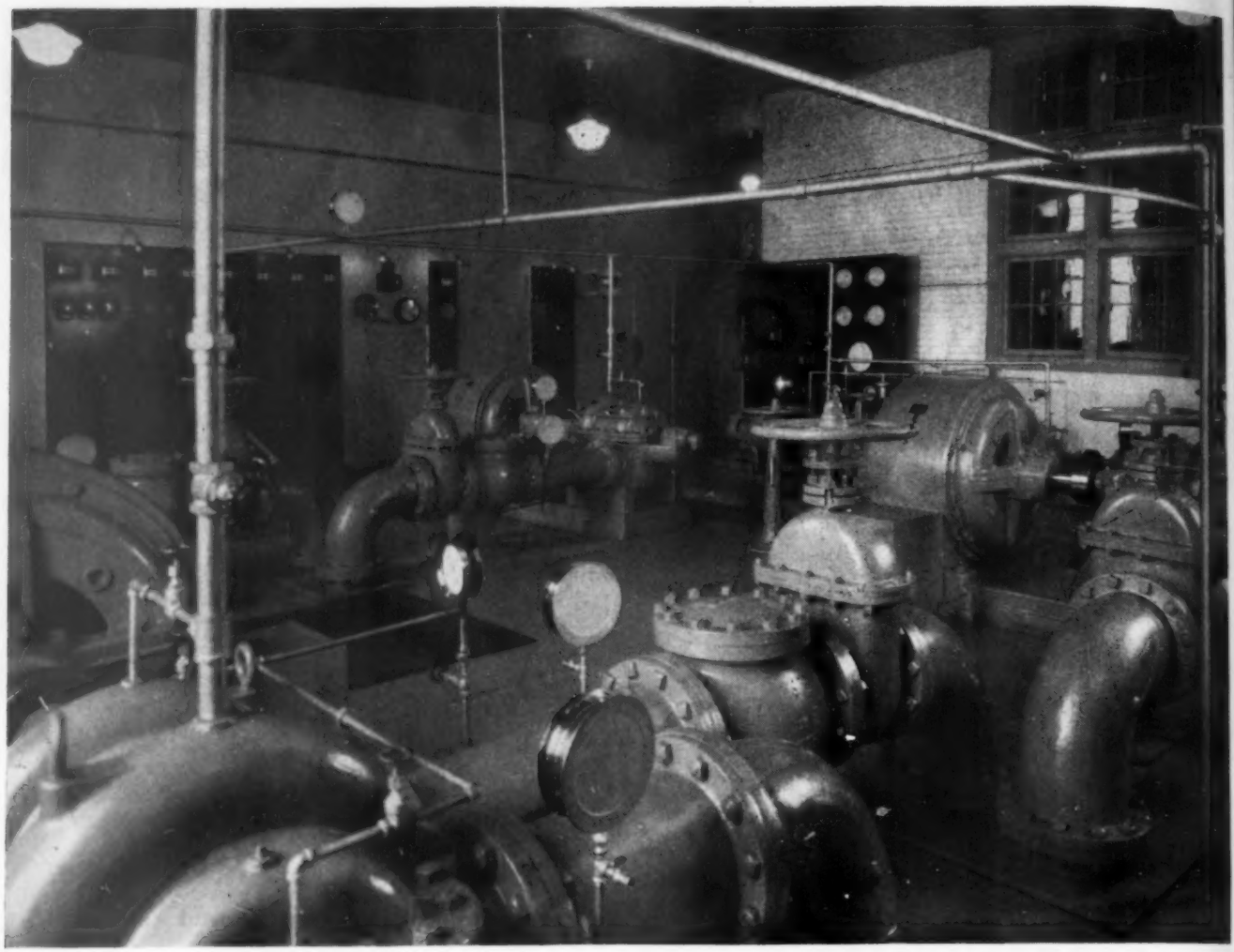
THE priceless wartime experience in executing exacting engineering and production tasks assigned to Badger Meter adds to the ability of an organization that has, for 39 years, been famous for precision production.

Fortified with this additional knowledge and experience, the Badger Meter organization will continue leadership in the precision production of water meters for home and industry when Victory is won.

Put Badger Water Meters first on your list in your postwar planning.

BADGER METER MANUFACTURING COMPANY
MILWAUKEE 2, WISCONSIN

BRANCH OFFICES: New York City • Tampa, Fla. • Seattle, Wash. • Savannah, Ga.
Kansas City, Mo. • Marshalltown, Iowa • Waco, Texas • Los Angeles, Calif.
Chicago, Ill. • Philadelphia, Pa.



ROCHESTER, N. Y.—Browns Race Station. Four 250 H.P. motor driven DeLaval pumps. Each 2,100 gpm—350 ft. head.

1 CONTRACT — COMPLETELY INSTALLED

In 1924 the City of Rochester desired the removal of old pumping engines and the installation of new motor driven pumps, together with new foundations, piping and valves, meters, priming equipment, main control switchboard and all electrical wiring.

One contract for all of this equipment completely installed was awarded to Turbine Equipment Company.

Turbine Equipment Company with 36 years of experience as equipment contractors are in a position to give you the same advantages of undivided responsibility in the installation of complete water works and sewage equipment.

TURBINE EQUIPMENT COMPANY

75 WEST STREET NEW YORK 6, N. Y.

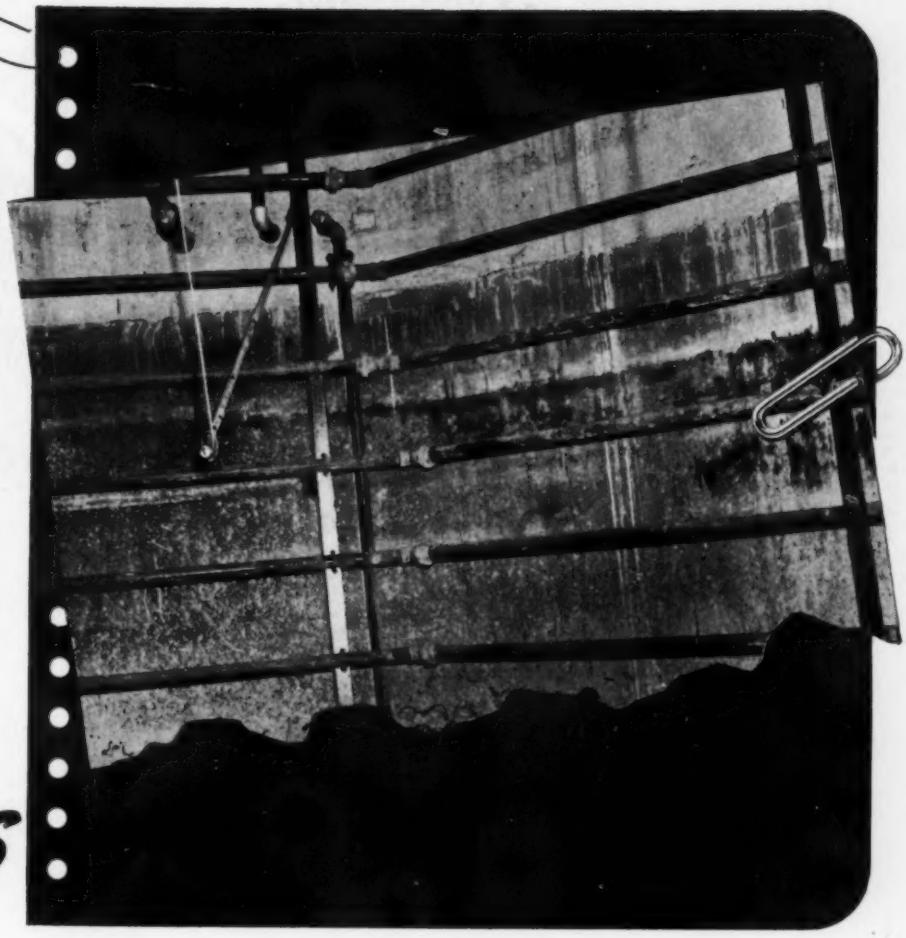
REPRESENTING AND SERVICING

DE LAVAL STEAM TURBINE CO.
DE LAVAL SEPARATOR CO.
PEERLESS PUMP CO.
YEOMANS BROS. CO.
COCHRANE CORP.

MAINTENANCE TIPS FOR CORROSIVE SEWAGE SERVICES

If your Digestors are Digesting the Heating Coils too . . .

Better use BYERS



No maintenance man wants the job of replacing heating coils in digestors, but you can't do much about it, once they've failed. You CAN do something to postpone the next failure, though, by taking a tip from the experience of other plants all over the country, and installing wrought iron.

The picture shows you one such recent installation, made by the Belgrave Sewer District when they carried out some improvements in the treatment plant at Great Neck, N.Y. Two new digestor tanks, each about 30-feet in diameter and 30-feet high, were installed. For the coils, the Board of Commissioners purchased Byers Wrought Iron.

At practically every stage in the treatment of sewage, severe corrosive conditions exist that little can be done to correct, and few services rival heating coils in digestors for severity of corrosive action. The action increases as the temperature goes up; some authorities assert that it doubles for every 20-degree rise. Further, the sludge tends to collect on the pipe surface, and under high temperature it decomposes and liberates highly corrosive compounds.

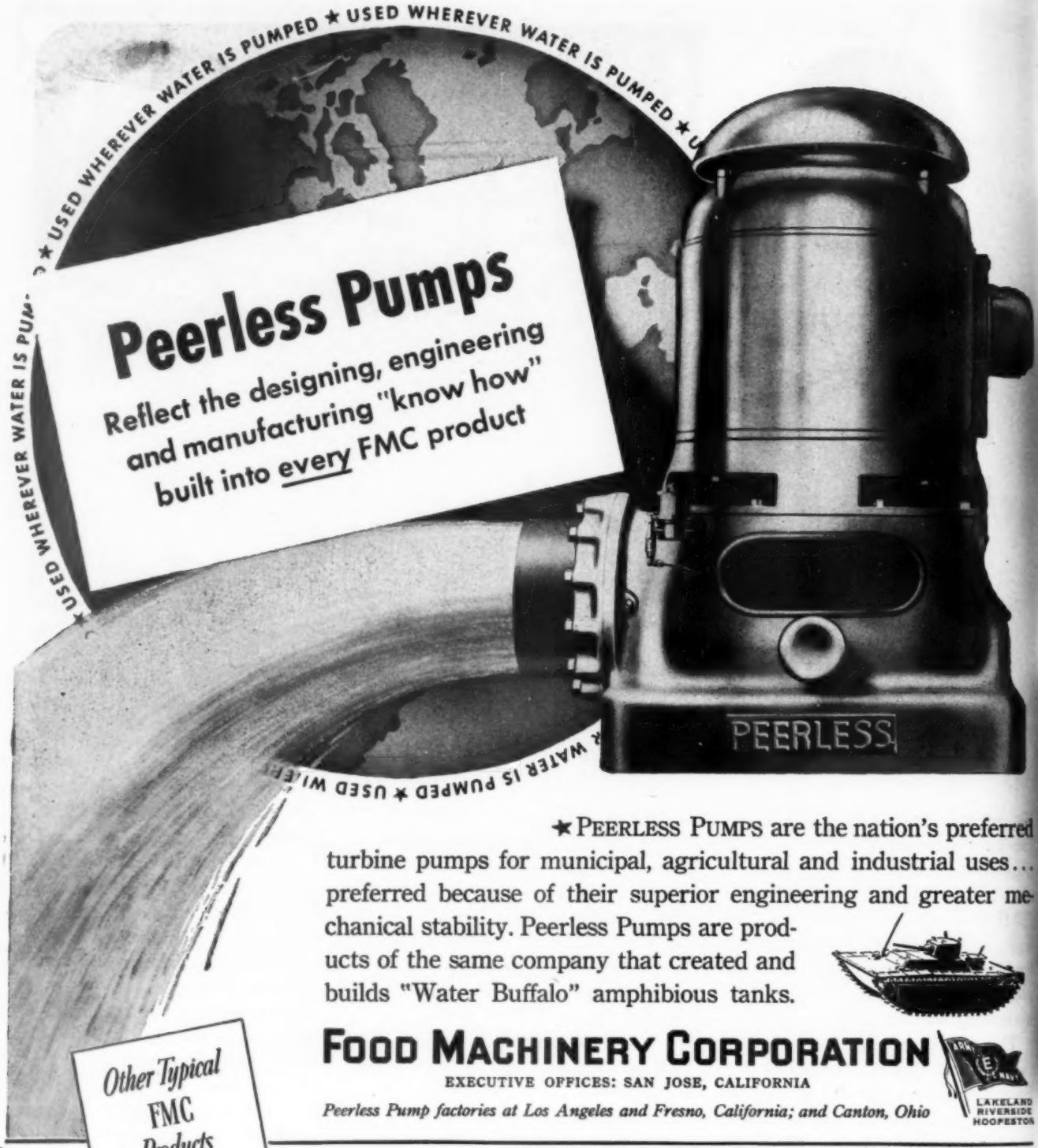
Wrought iron has proven itself unusually resistive to this particular corrosive attack, and is serving in modern plants in New York, Indiana, Massachusetts, Pennsylvania, Connecticut, Illinois, Texas, and Rhode Island . . . to mention a few. This wide-spread and continued use is the best evidence of its durability.

The corrosion resistance of wrought iron is the direct result of its unique structure. Tiny fibers of glass-like silica slag are threaded through a body of high-purity iron. The fibers act like baffles, to halt and diffuse corrosive attack, and so to prevent the local pitting that causes failure of ordinary materials. Furthermore, the fibers anchor the initial scale, which helps to shield the underlying metal.

You'll find some interesting and helpful maintenance tips in our bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations." We will be glad to send you a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON


USED WHEREVER WATER IS PUMPED ★ USED WHEREVER WATER IS PUMPED ★
Peerless Pumps
Reflect the designing, engineering and manufacturing "know how" built into every FMC product
PEERLESS

★ PEERLESS PUMPS are the nation's preferred turbine pumps for municipal, agricultural and industrial uses... preferred because of their superior engineering and greater mechanical stability. Peerless Pumps are products of the same company that created and builds "Water Buffalo" amphibious tanks.

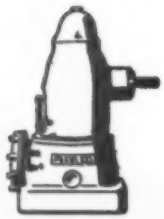
FOOD MACHINERY CORPORATION

EXECUTIVE OFFICES: SAN JOSE, CALIFORNIA

Peerless Pump factories at Los Angeles and Fresno, California; and Canton, Ohio

LAKELAND
RIVERSIDE
HOOPESTON

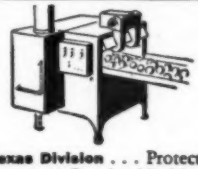
Other Typical FMC Products



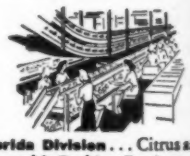
PEERLESS PUMP DIVISION... Deep well turbines, hi-lifts and Pumps handling water for every purpose. Los Angeles and Fresno, California; and Canton, Ohio.

Sprague-Sells Division . . . A complete line of machinery for canning foods. Hoopeston, Ill.

Anderson-Barngrover Division Complete line of machinery for canning foods. San Jose, Calif.



Texas Division . . . Protective Processes. Canning Machinery, Fruit and Vegetable Packing Equipment. Harlingen, Texas.



Florida Division . . . Citrus and Vegetable Packing Equipment, and Food Protective Processes. Dunedin and Lakeland, Florida.

Niagara Sprayer & Chemical Co. . . . Insecticides for protecting crops from insects and disease. Middleport, N.Y.; Jacksonville, Fla.; and Burlington, Ont., Can.

Riverside Division. Citrus Packing Equipment, Automatic Box Making & Lidding Machinery. Fruit and Vegetable Protective Processes. Riverside, Calif.

Bean-Cutler Division. Sprayers, Dusters and Packing House Equipment for Fruits & Vegetables, Fog Fire Fighters, Turbine Pumps. San Jose, California.

John Bean Mfg. Co. Fog Fire Fighters, Bean Royal Spray Pumps, Automotive Service Station Equipment. Lansing, Mich.

Here at Niagara...

Covering an area of nearly thirty acres, Niagara Alkali Company's plant at Niagara Falls, N. Y., is one of the most modern and efficient of its kind in the world

• • • WE ARE naturally proud of our more than forty years of pioneering in the field of electro-chemical products. But we feel that the present and future are infinitely more important. Today we are operating with new and expanded facilities to meet the unprecedented demands of war. Tomorrow we will be prepared to use these new facilities and new war-born experience to give even more efficient service to industry.

Niagara ALKALI COMPANY

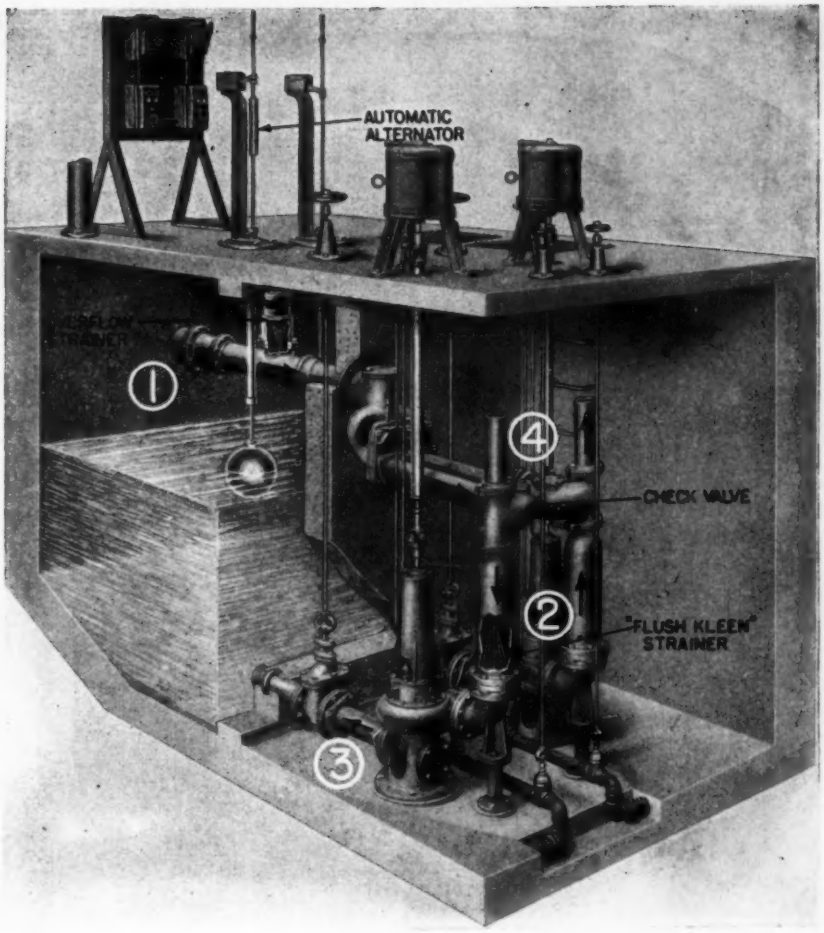
60 EAST 42nd STREET, NEW YORK 17, N. Y.

CAUSTIC POTASH • CAUSTIC SODA • PARADICHLOROBENZENE • CARBONATE OF POTASH • LIQUID CHLORINE

Caustic Potash · Caustic Soda · Liquid Chlorine

Paradichlorobenzene · Carbonate of Potash

Offset MANPOWER SHORTAGE with "FLUSH-KLEENS"



NO EXTRA MANHOURS REQUIRED FOR CLEANING CLOGGED PUMPS

"Flush-Kleens" provide automatic, trouble-free sewage lift station service without manual attention, except for periodical lubrication. They cannot clog, because solids do not pass through the impellers. No labor is required for disassembling and cleaning as with other types of sewage pumps. Maintenance labor is greatly reduced, because "Flush-Kleens" have a longer life than other sewage pumps. This is due to the fact that the impellers handle water, only. No solids pass through to throw the pumps out of balance and cause excessive strain and wear on impellers, casings, bearings, shafts and motors.

SEND FOR BULLETIN 122 WITH COMPLETE "FLUSH-KLEEN" ENGINEERING DATA

"FLUSH-KLEENS" OPERATE ALTERNATELY

Sewage flows into basin through idle pump

FILLING WET WELL

① Sewage flows through inlet pipe.
② Coarse sewage matter is retained by strainer.
③ Strained sewage flows through idle pump to basin.

PUMPING

③ Strained sewage is pumped from basin.
② Coarse sewage matter is backwashed from strainer.
④ Special check valve closes; sewage and coarse matter are pumped to sewers.

Both pumps operate under peak flows.

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2349 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush-Kleen, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs, Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

Blueprint FOR TOMORROW'S NEEDS Now!

SIMPLEX

INCREASE FLOW CAPACITY 40% TO 60%

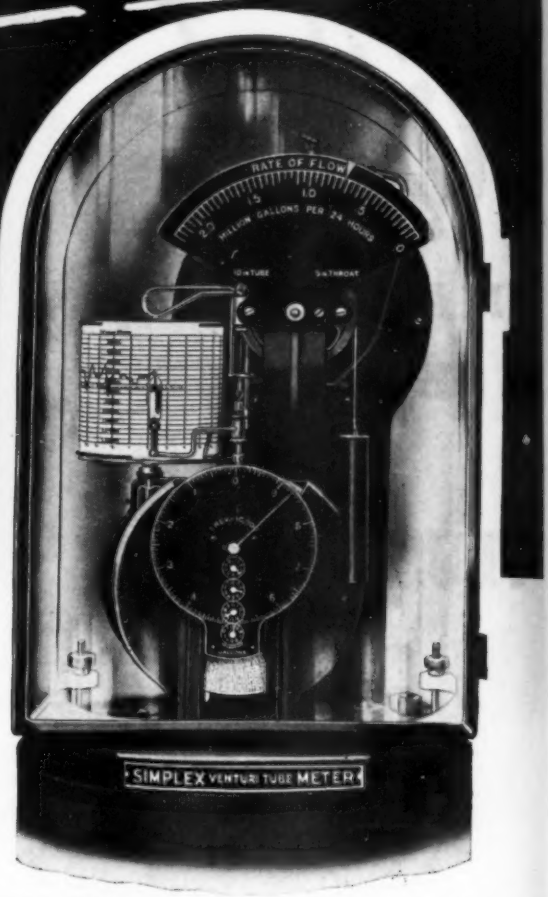
MOL or MOLA METERS

with flow ranges

FROM **20 to 1**

TO **28½ to 1**

OR TO **40 to 1**



Two typical examples of the ease and economy of increasing the maximum capacity of flow lines with the use of Simplex MOL and MOLA wide-range meters are given below:

1. **A change in operating heads enabled a large municipal water department to increase the total capacity of one of their pumps from a maximum of 60 million gallons per day to 72 million gallons per day by replacing the existing Simplex MO Meter with a Simplex MOL Meter. No change in the Venturi Tube, Pump Impeller, or motor was required, and operating costs showed a marked decrease.**

2. **By substituting an MOLA Meter for an MO Meter, increased requirements were met without any change in the Venturi tube, permitting an increase of from 13 million gallons per day to 21 million gallons per day.**

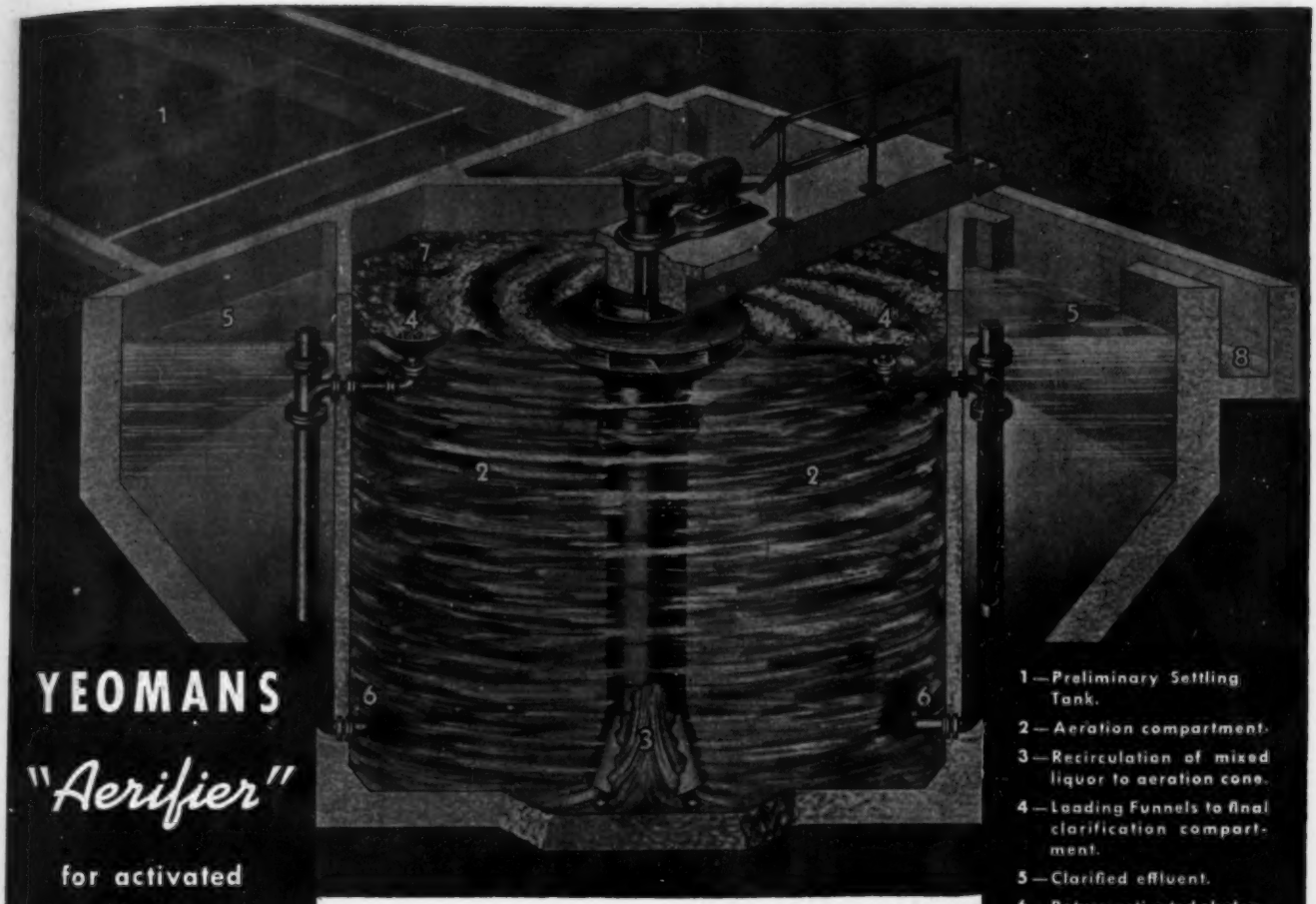
Simplex MOL and MOLA meters are designed to function over extremely wide flow ranges—and the accuracy of measurement and totalization is maintained at both maximum and minimum ends of the range.

Look into the advantages and economies of making use of Simplex instruments for performing the extraordinary as well as the conventional metering operation.

Write today; our recommendations are made without obligation.

SIMPLEX VALVE & METER COMPANY

6743 UPLAND STREET, PHILADELPHIA 42, PA.



YEOMANS "Aerifier"

for activated sludge treatment of sewage

1—Preliminary Settling Tank.
2—Aeration compartment.
3—Recirculation of mixed liquor to aeration cone.
4—Loading Funnels to final clarification compartment.
5—Clarified effluent.
6—Return activated sludge.
7—Waste activated sludge loading funnel to primary tank.
8—Plant effluent.

AERATION AND FINAL SETTLING IN ONE CONCRETE STRUCTURE

HERE'S an answer to the sewage problem of small communities — the Yeomans "Aerifier". It is designed and built to do an efficient job economically—with a minimum of attention for operation and maintenance.

Square concrete tank, with central aeration section and triangular corner settling compartments, connected only by influent and effluent pipes. No steel baffles to rust and collapse.

Motor-driven "Spiralflo" aeration cone revolving at relatively low speed, sets up spiral circulation from top down—delivers a high degree of purification at exceptionally low power cost.

Exclusive design for conveying mixed liquor to settling compartments. Capacity under control of the operator.

No possibility of short circuiting from aeration compartment to clarifier. No annular openings.

Adequate velocity from "Spiralflo" movement—no sludge deposit on tank bottom. Activated sludge is returned from settling compartments to aeration compartment, and clear effluent is discharged. Waste activated sludge is returned directly to the primary tank.

For full detailed information concerning this simple, efficient, modern unit, send for new Bulletin 6650.

Yeomans Brothers Company

1423 NORTH DAYTON STREET
CHICAGO 22, ILLINOIS

YEOMANS PUMPS • ONE YEOMAN SERVICE •

Please send Bulletin 6650 describing Yeomans Aerifier.
Name_____
Address_____
Company_____

IMPORTANT

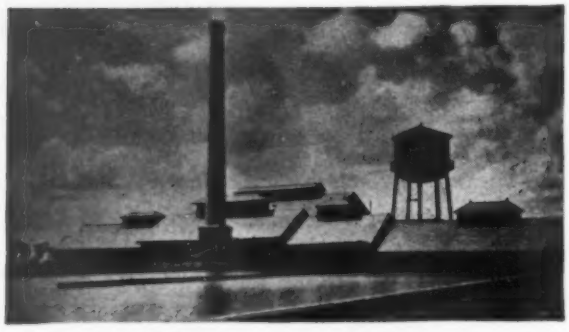
Public Health must be maintained!

The necessity of maintaining public health in war time is self-evident. Municipal officers in charge of water purification and sewage disposal have a vital responsibility in guarding the nation's health which should not be underestimated as a contributing factor to final victory.

However, the problems of maintaining public health are *becoming increasingly difficult in the face of material shortages and transportation handicaps.* General's "Alum" will help do the job right. But to ease the situation in regard to *Aluminum Sulfate* as much as possible, won't you place your orders as far ahead as you can so that we may schedule our production on an efficient basis.

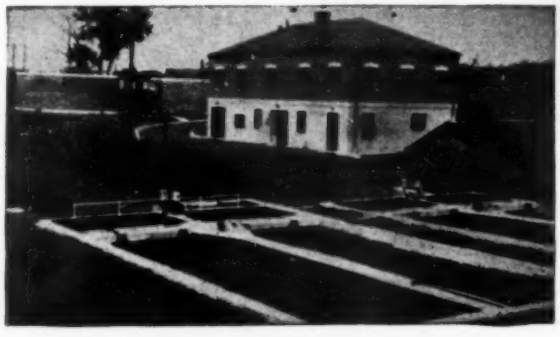
Why Most American Cities Prefer General Chemical Aluminum Sulfate

General Chemical Aluminum Sulfate is an especially developed "Alum." High quality and constant uniformity have given it a *time-tested* reputation among water works engineers and sewage plant operators, who know its reliability through experience.



★ FOR WATER WORKS

1. Makes water crystal clear.
2. Longer filter runs are obtainable.
3. Is economical, used properly will conserve chlorine supplies . . . because it does not require oxidation to make it effective.
4. Superior in tests against other coagulants.
5. High in quality, its constant uniformity can be counted upon.



★ FOR SEWAGE PLANTS

1. Clean, easy to handle and economical to use.
2. Simple application, requires only low cost feeding apparatus and minimum attention.
3. Clear, colorless effluents are possible.
4. Precipitated sludge digests readily.
5. Treated digested sludge dries quickly, without odor.

GENERAL CHEMICAL COMPANY

GENERAL CHEMICAL COMPANY

40 RECTOR STREET, NEW YORK 6, N. Y.

Technical Service Offices: Atlanta • Baltimore • Boston • Bridgeport (Conn.) • Buffalo • Charlotte (N.C.) Chicago • Cleveland • Denver • Detroit • Houston • Kansas City • Milwaukee • Minneapolis New York • Philadelphia • Pittsburgh • Providence (R. I.) • St. Louis • Utica (N. Y.)

Pacific Coast Technical Service Offices:
Los Angeles • San Francisco • Seattle, Wenatchee and Yakima (Wash.)

In Canada: The Nichols Chemical Co., Ltd. • Montreal • Toronto • Vancouver

Product improvement through

BRIDGEPORT DURONZE

A product is no better than its weakest part... often a simple part. For example, a carefully designed water meter may be unsatisfactory merely because steel bolts and nuts have rusted and "frozen" in place. When that happens, servicing the meter becomes more costly and time-consuming. Such a situation may easily be avoided by using assembly bolts and nuts made from Bridgeport's non-rusting, high-strength, corrosion-resistant DURONZE. Even in relatively simple parts, it soon pays out in maintenance savings and exceptionally long life.

Hard drawn DURONZE wire has remarkable malleability. Illustrated are the most important steps in Wolverine Nut Company's economical and material-saving process of making nuts by cold upsetting round wire. DURONZE bolts average over 100,000 lbs. per square inch in tensile strength.

Perhaps *your* product can be radically improved without any change in design, merely by substituting a Bridgeport modern engineering alloy for a vulnerable part...especially where problems of excessive corrosion, wear, fatigue or deteriorating are involved.

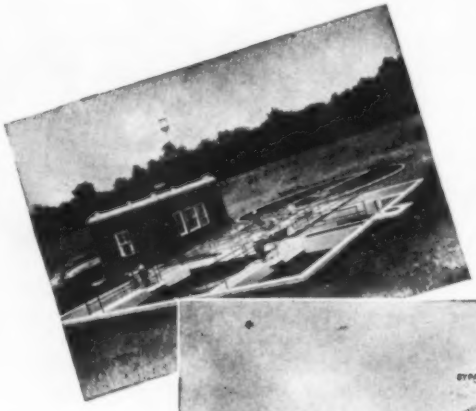
We supply DURONZE sheet, strip, rod, wire and tubing for the manufacture of strong, wear-resisting parts by hot forging, cold forging or machining.

Send for Bridgeport's 80-page DURONZE Manual, which contains technical data on five outstanding engineering alloys. Write for your free copy today.

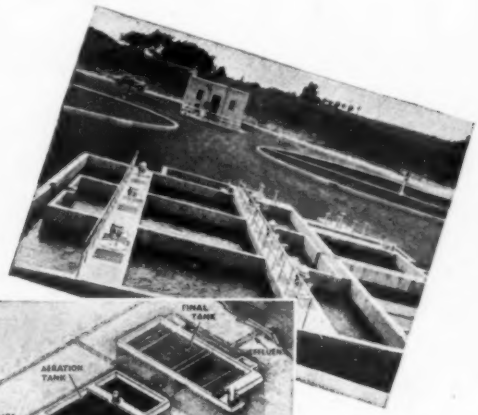
Orders for DURONZE sheet, rod, wire or tubing will be accepted in accordance with existing priority regulations.

American Bio-Activation

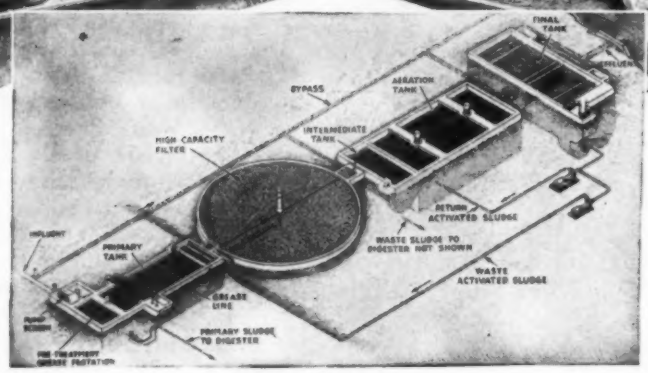
WASTE TREATMENT



COVINGTON
OHIO



CHILTON
WISCONSIN



FLOW SHEET

Bio-Activation combines the best qualities of both the trickling filter and the activated sludge process to produce a completely stable, nitrified effluent, low in B. O. D. and suspended solids.

TYPICAL OPERATING RESULTS

	Domestic, Malt, Brewery and Canning Wastes	
	5 BOD	Suspended Solids
Raw Waste	342	370
Primary Effluent	235*	134
Influent to Filter	510†	.....
Filter Effluent	99	143
Intermediate Effluent	58	65
% Reduction Filter Influent through Intermediate Effluent	89.5	.....
Final Effluent	13	15
% Overall Removal	97.5	96

*High Soluble 5 BOD from malt and brewery.
†Pea waste; 600-1200 ppm. 5 BOD, added in primary effluent.

Blue Print Now!—Send for Bulletin No. 259

AMERICAN
ESTABLISHED 1868

THE AMERICAN WELL WORKS

Manufacturers of
PUMPING · SEWAGE TREATMENT · WATER PURIFICATION EQUIPMENT ·
RESEARCH · ENGINEERS · MANUFACTURERS · Factory and Laboratories · · · AURORA, ILLINOIS

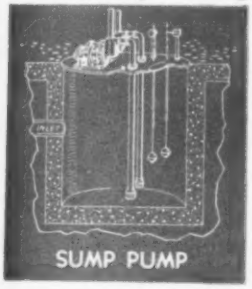
CARTER Self-Priming Centrifugal Pumps

CARTER Model 701-1-½-A Self-Priming Industrial Pump

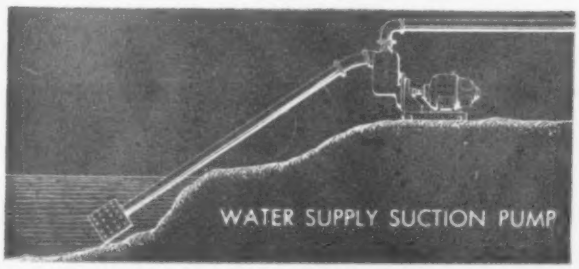
The present day type of this simple, compact, highly efficient and low-initial-cost pump was pioneered by CARTER, who has contributed more than any other manufacturer to its evolution and wide adoption in public works and private industry.

EXCLUSIVE FEATURES of the CARTER Close-coupled type pictured above include *Renewable Bronze Pump Shaft,* obviating expensive delays and replacements after extensive shaft wear . . . and *Flexibility of Motor Drive,* allowing use of any standard make of ball bearing motor. As the priming operation does not depend upon any Trick Impeller or Volute, CARTER Pumps follow the latest proven designs used in high grade non-priming centrifugal pump construction and have the same non-clogging and high efficiency characteristics.

Here are a few of the many fields in which CARTER Self-Priming Pumps are efficiently and economically "doing the job":

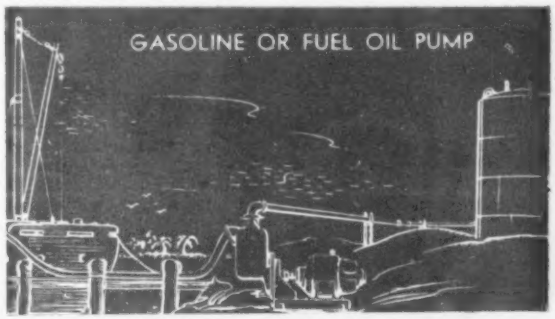


SUMP PUMPS . . . replacing older vertical submerged type. ADVANTAGES include accessibility of pump and motor, and elimination of long shaft with bearing, vibration and lubrication problems. CARTER Self-Priming Pumps may be placed alongside or away from sump pit, as may be desirable in some industrial locations.



WATER SUPPLY SUCTION PUMPS. Wherever the supply source is within suction limit, a CARTER Self-Priming Pump should meet your need. Combines simplicity and efficiency of Centrifugal Pump with suction lift ability of Plunger or Rotary Pump. These CARTER Pumps are widely used by the Army and Navy for permanent and mobile water supply units, as well as by industry. In PUBLIC and PRIVATE SWIMMING POOLS they "vacuum clean" and render filter service . . . and in CONSTRUCTION DEWATERING, CARTER Self-Primers have proven themselves to be "tough pumps for tough jobs."

GASOLINE OR FUEL OIL PUMPS. In this work CARTER Self-Priming Pumps are serving at home and abroad, giving tip-top service under all sorts of adverse conditions.



SEAL RING. CARTER Self-Priming Pumps are equipped with stuffing box or seal ring type seal pictured. Either construction provides an effective, trouble-free method of sealing the pumped liquid at rotating shaft. Replacing seal ring or renewal of packing is an easily accomplished operation, requiring only a few moments.

We invite you to submit your pumping problem to our Engineering Department whose experience and skill are at your command. Further details of CARTER Self-Priming Pumps are covered in our Bulletin WS-4310 which will be mailed upon request.

RALPH B. CARTER COMPANY

Main Office
HACKENSACK, N. J.

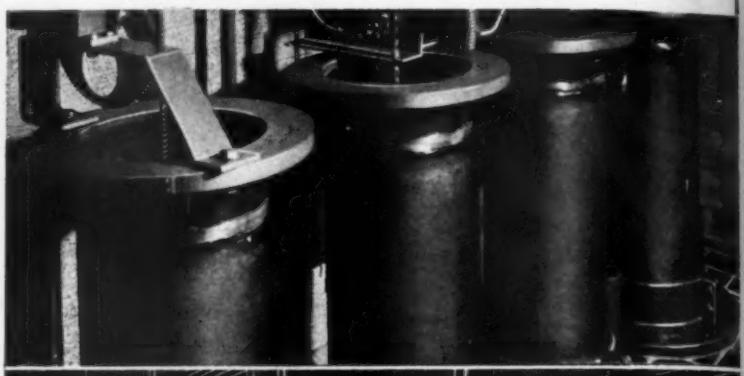
New York Office
53 Park Place, NEW YORK 7

A Report *on Everdur Equipment*

IN WARD'S ISLAND SEWAGE DISPOSAL PLANT

which Handles 200 Million Gallons Daily

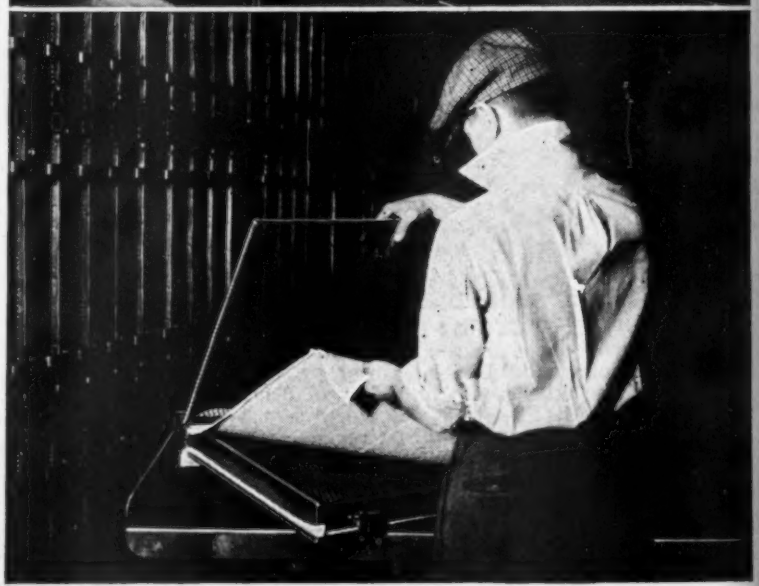
✓ Everdur* float tubes—12 inches diameter—45 feet long. *Condition after nearly 7 years of continuous operation:* sulphide tarnish outside—no corrosion inside.



✓ Air filter of primary room. Entire structure is Everdur, bolted and welded. Rotating Everdur screen coated with plastic compound to facilitate adherence of oil bath. *Condition after nearly 7 years of continuous operation:* no effect of corrosion or wear.

✓ Air filter of secondary room. Framework and filter holders are welded and bolted Everdur sheets and strip. *Condition after nearly 7 years of continuous operation:* filter retainers have thin green patina—no other corrosion apparent.

44133



AGAINST SEVERELY CORROSIVE CONDITIONS, EVERDUR COPPER SILICON ALLOY MAINTAINS ITS ENVIABLE PERFORMANCE RECORD.

ANACONDA

Everdur Copper-Silicon Alloy

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company—In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

*Reg. U.S. Pat. Off.

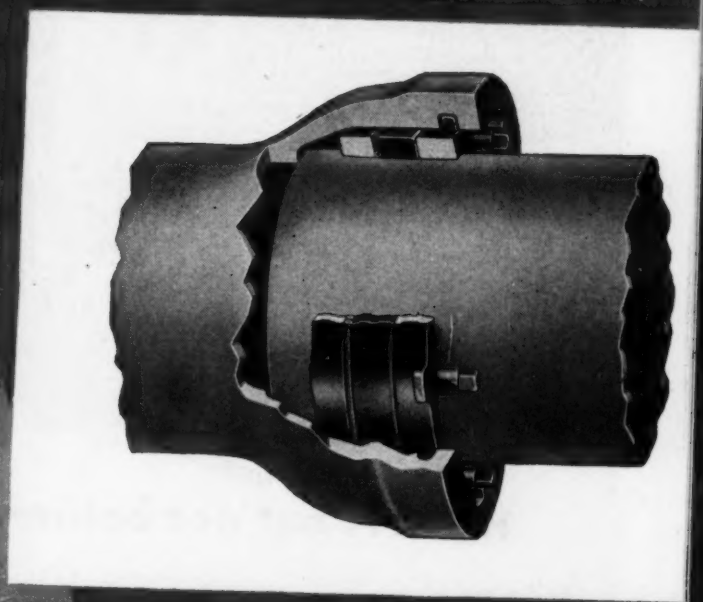
Light-Weight and Easy-to-Handle

DRESSER Bellmaster Joints

Style 85

FOR CAST-IRON PIPE LINES

This 6" Dresser Bellmaster only weighs 8 lbs.



Above you see a workman holding a 6 inch Dresser Bellmaster (weight, 8 lbs.) just as it reached the storeroom—a completely factory-assembled unit, ready for work.

It will take the workman no more than 2 to 5 minutes to make up the permanently tight pipe connection. He has only to wipe out the bell, insert the Joint, wipe and stab in the spigot, and tighten the capscrews with a small wrench. No bell-holes needed.

The cutaway view illustrates the working principle of this new mechanical Joint. A resilient gasket is compressed between two light, strong, malleable rings and against the pipe, by capscrews. This effects a constant, flexible seal, bottle-tight even under unusual conditions of expansion, contraction, deflection and vibration.

Thus effectively the ancient problem of cast-iron pipe joining has been solved. The Joint itself, locked in the bell of the pipe, is safe from attack by corrosion. CIP lines are given new protection from leaks and breaks —new operating efficiency.

Grooves rough-cast in the inner circumference of the bell accommodate the locking lugs, and slots on the face of the bell permit lug passage. Your regular source of supply can furnish Bellmaster pipe—and we are ready to make prompt delivery of Bellmaster Joints. Sizes 3", 4", 6", 8", 10", 12", 16" CIP.

INQUIRIES CORDIALLY INVITED

DRESSER MANUFACTURING COMPANY • BRADFORD, PA.

ONE OF THE DRESSER INDUSTRIES

HOT . . . but not bothered

And when we say "hot", we mean 120° in the shade . . . and of course, much hotter inside the gasoline engine of a Homelite Portable Generator. But there's no question of "burning up" . . . for the engine is air-cooled. There's no radiator to boil over or run dry.

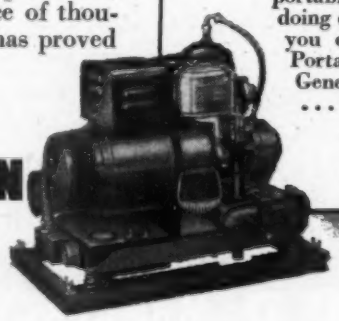
A large fan on the flywheel sends a constant blast of air over the cylinder. Shields direct this air across the fins of the aluminum cylinder . . . providing maximum cooling. Complete lubrication is assured . . . for oil is mixed with the gasoline and sprayed under pressure into all moving parts. No sludge . . . no dirty oil . . . for a fresh, clean film of oil enters the crankcase with each revolution.

And the most interesting thing is this . . . the means of protecting a Homelite from heat, is also the means of protecting it from cold. There's no radiator to freeze. And lubrication is the same hot or cold . . . for oil mixed with gasoline won't congeal, even at sub-zero temperatures.

From broiling tropical heat down to sub-zero arctic temperatures, a Homelite performs without trouble. The performance of thousands of Homelites with the armed forces everywhere has proved this point *plenty*.

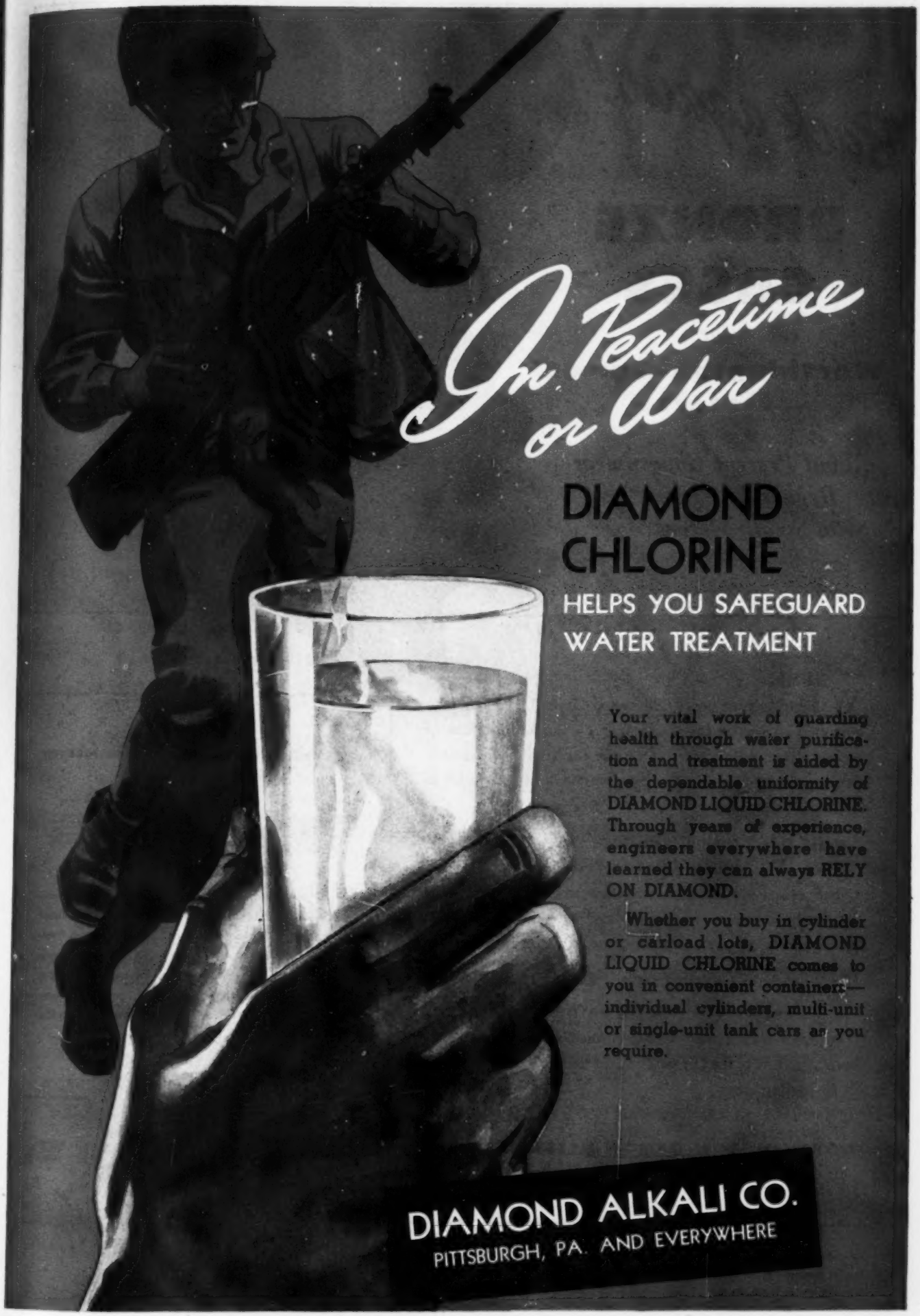
Water Works Departments have maintenance troubles all through the year . . . the hottest days in summer and the coldest days in winter. And as your men must work so must your equipment.

For doing this work fast . . . with portable electric tools . . . or for doing emergency work at night . . . you can depend on a Homelite Portable Gasoline-Engine-Driven Generator for your power supply . . . rain or shine . . . hot or cold.



HOMELITE CORPORATION

PORT CHESTER, NEW YORK


In Peacetime or War
DIAMOND CHLORINE
HELPS YOU SAFEGUARD WATER TREATMENT
Your vital work of guarding health through water purification and treatment is aided by the dependable uniformity of DIAMOND LIQUID CHLORINE. Through years of experience, engineers everywhere have learned they can always RELY ON DIAMOND.
Whether you buy in cylinder or carload lots, DIAMOND LIQUID CHLORINE comes to you in convenient containers—individual cylinders, multi-unit or single-unit tank cars as you require.
DIAMOND ALKALI CO.
PITTSBURGH, PA. AND EVERYWHERE

Back again!

BRONZE CASES

for

Worthington-Gamon Meters

...but Present Government Regulations Limit Use to Small Meters

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It shows how the natural heat of hydration of Ferrisul, Monsanto's efficient, flexible coagulant for water and sewage treatment, can be used to speed mixing with water *whatever the temperature of your tap water.*

Ferrisul, the only *anhydrous* ferric sulfate available for water and sewage treatment, is therefore the only ferric sulfate which creates heat when mixed with water. This means it is the only ferric sulfate that can be quickly and completely dissolved in cold water by simply adjusting your ferric sulfate : water ratio. (Mechanical agitation must be provided.)

Ferrisul Dissolves in 18-25 Minutes

For example, if your tap water is 40°F., one part of Ferrisul added to three parts of water will raise the temperature in your mixing pot to 92°F. . . . *and the Ferrisul will be completely dissolved in about 22 minutes.*

On the other hand, if your tap water is 80°F., you will want to add 10 to 15 parts water to one part Ferrisul . . . producing a temperature of 89° to 94°F. in the mixing pot . . . and dissolving the Ferrisul in 18 to 25 minutes.

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Because its floc forms rapidly . . . settles quickly . . . and is effective over the entire pH range above 3.5 . . . Ferrisul handles wide seasonal variations in raw water and even wider *daily* variations in sewage with maximum efficiency and a minimum change in treatment.

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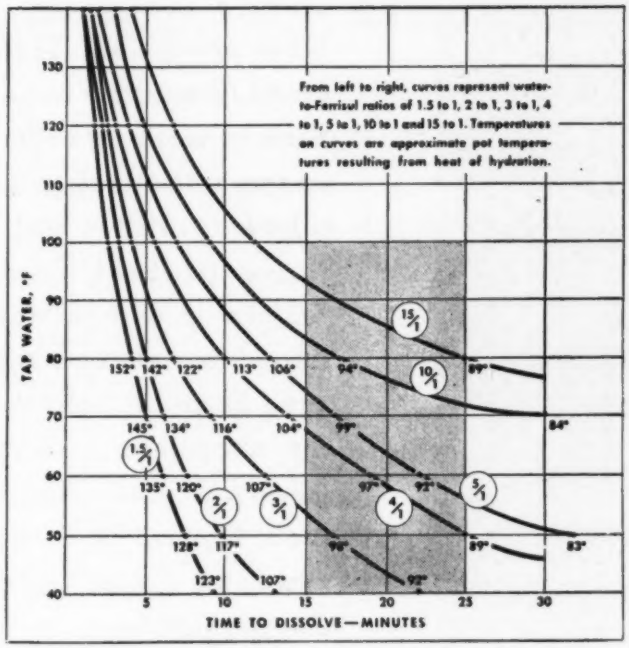

These curves show: (1) what temperature will be produced in the mixing pot by seven different Ferrisul : water ratios as the temperature of the water added varies, and (2) how long it will take Ferrisul to dissolve in each of the seven ratios illustrated as the tap water temperature varies. For best results, it is recommended that Ferrisul : water ratios be changed as the temperature of your tap water changes so that mixing pot temperatures will always remain between 89° and 100°F. (shaded area). In this way, Ferrisul will always be completely dissolved in 15 to 25 minutes. For more details on Ferrisul dissolving and feeding, write for the new, four-page leaflet, "Feeding Data for Ferrisul."

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A particularly important point, since the efficiency of any ferric sulfate coagulant is determined entirely by its ferric sulfate content, Ferrisul is the *only* commercial product which contains a minimum of 90% ferric sulfate.

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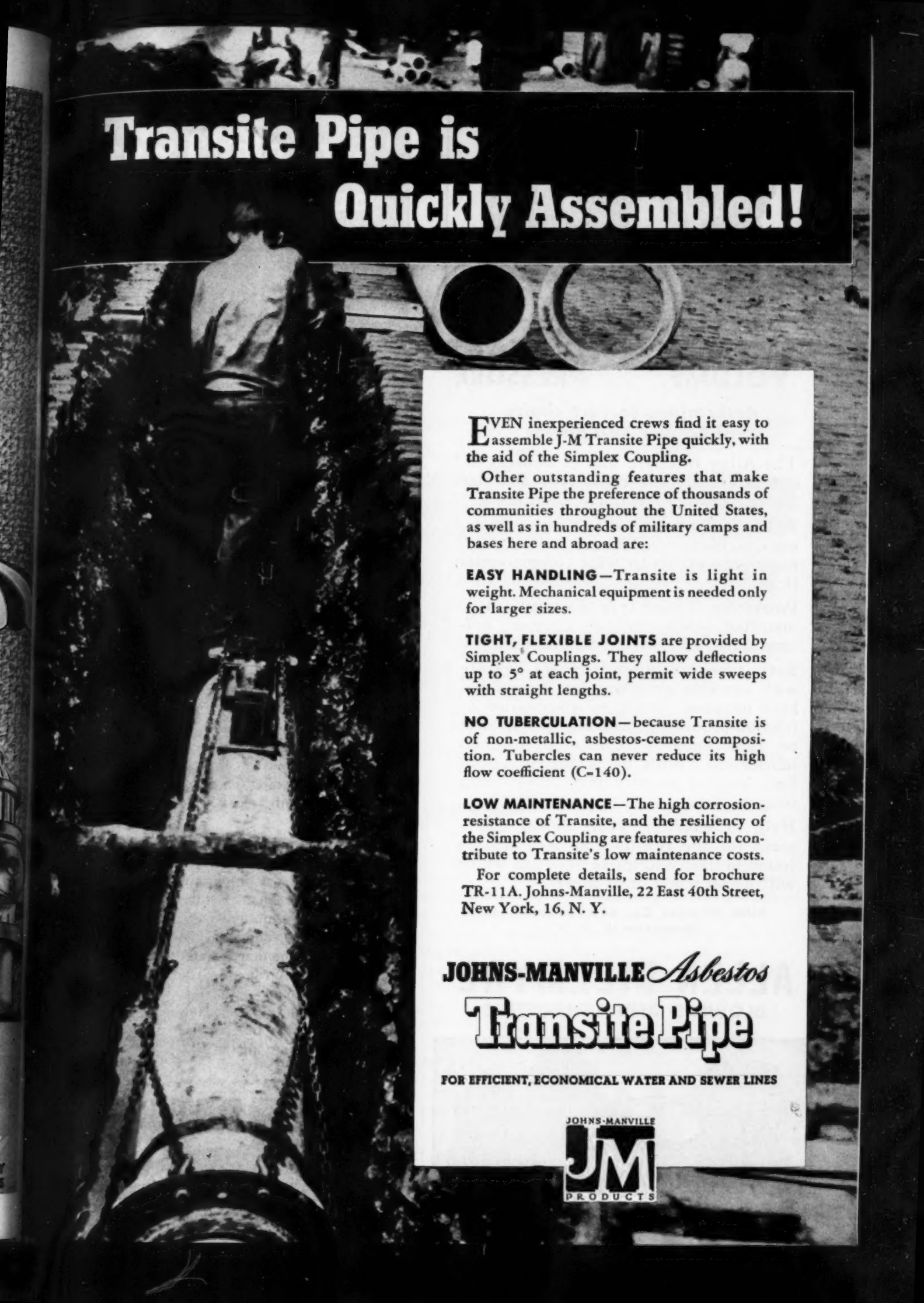

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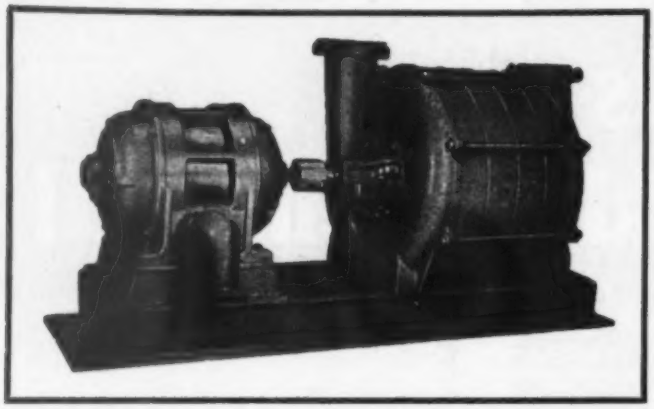

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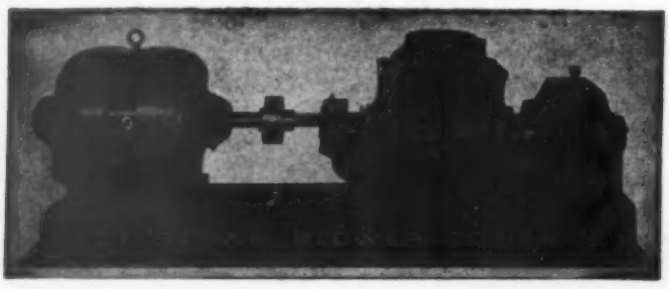

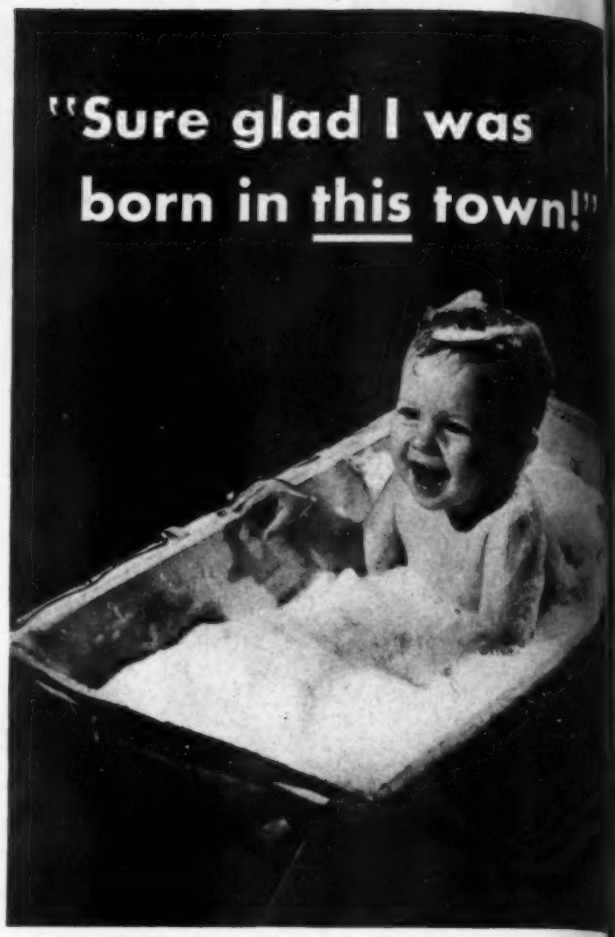

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E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
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COMING!

Organizing and Financing Sewerage Districts

Is an account of experiences and methods used in developing some of the most important sanitary districts in this country and methods of financing construction and operation by these political subdivisions independently of the municipality, or municipalities, served. The author, who has seen this development from its earliest beginning, is—
M. W. LOVING, Exec. Secy.,
Am. Concrete Pipe Assn., Chicago.

Rejuvenating Rock Wells

Is an account of the successful application of basically the same methods employed in the development or rejuvenation of sand and gravel wells to rock wall wells. In all instances when the method has been applied the result has been a gratifying increase in yields from these rock wells. The author, who is co-chairman of A.W.W.A.'s Committee on Deep Wells is—
J. ARTHUR CARR,
Supt. of Water, Ridgewood, N. J.

Gas Engine Performance and Economics

Is an account of the dependable performance, operating experiences and economy of sludge gas engines serving the sewage treatment works of Marion, Ind. Four years of operation of this modern plant, under supervision of a wide-awake young superintendent with universally complete records, is ample proof once more of the attractive economics of gas engines in modern sewage works operation. The record is set forth by—
DAVID BACKMEYER, Supt.,
Sewage Treatment Works, Marion, Ind.

The Value of Sewage Treatment Plant Records

Has been nowhere better proven than at Kenosha, Wis., where used to advantage not only in plant control but also in connection with a court case regarding the presence of copper bearing wastes in the sewage, causing cessation of proper digestion of the sludge. This case, now before the Wisconsin Supreme Court, has received nation-wide attention. The story of the case, and the part that plant records played, comes from—
H. D. RUDGAL,
Supt. of Sewage Treatment, Kenosha, Wis.

A "Lace Curtain" Piping Station

Is, as its name signifies, an unique architectural design of a high pressure pumping station in the heart of a residential district. The story and photographs of this station should be an inspiration and guide to municipalities who are planning postwar construction of war pumping and treatment service buildings. This station was designed under the direction of the author of the article—
EARL R. PERRY, Chief Engineer,
Bureau of Engineering, Worcester, Mass.

With Regrets and Apologies!

The restricted use of paper forces us to curtail the number and length of reports of sectional meetings of water and sewage works groups. It is apparent that to produce balanced issues of *Water Works and Sewerage*, until the paper restrictions are eased, we shall have to print shorter and inadequate meetings reports or print fewer reports. Choosing the latter policy, we shall be able henceforth to report, this year, only those sectional meetings not reported in 1943. Having already prepared reports covering the recent meetings of the Md.-Delaware Water & Sewage Assn. and the Maine Water Utilities Assn., we regret that we have been unable to print either. Our apologies to all concerned, especially to the Governor of Maryland.
—L. H. E.

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BUY WAR BONDS

The Daily

VOL. 78 — No. 280 NEWS SECTION MONDAY, MAY

Water Department Increases Revenue and Reduces Water Rates

Council Congratulates Superintendent On Payment of $29000

Regular Meter Testing Program Given Credit for Economies

As a result of his outstanding performance, the Town Council today at a special meeting accepted reduced rates and highly congratulated Superintendent — of the Water Works for his services. Today the Water Department is one City Department that not only seeks no budgetary appropriation from the Common Council, but actually pays money in taxes. The Department is turning over yearly in cash an average of about $29000. As a result of last year's business, it has been determined that a further reduction in rates is possible, to a point that is now the lowest in the history of the plant. In a special interview with the Superintendent, a reporter from the Inquirer obtained figures to show how this remarkable result was achieved.

The Superintendent in his work has accumulated a large fund of statistics about his water meters, which assists him in his operations. One of the most interesting facts is that some 13% of all water used in the domestic household is run at the rate of about ¼ gallon a minute. As a result, domestic ⅝" meters are being repaired to test up to 95% or better on ¼ gallon a minute. Due to this high standard of meter efficiency, a greater proportion of the water pumped is now being paid for than ever before. This is one of the factors accounting for the increase in revenue.

It is notable that in a representative group of 229 meters which were in service an average of 73½ months, the cost per meter for repair materials was only 24.2 cents.

Modestly disclaiming a great deal of credit for the results achieved, the Superintendent praised his hard working men in the Water Department, and the advisory assistance given him by the representative of the Neptune Meter Company.

(Figures quoted above based on actual practice)

100

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WATER WORKS & SEWERAGE

VOL. 91, No. 8 *A Gillette Publication* AUGUST, 1944

MUNICIPAL DEPRECIATION ACCOUNTING PRACTICES

By N. T. VEATCH
Black and Veatch, Engineers
KANSAS CITY, MO.

THIS paper is the outgrowth of a discussion which took place at a meeting of the Finance and Accounting Division of the American Water Works Association during the annual convention of that Association, held at Cleveland, Ohio, in June, 1943. The discussion brought out the fact that there is a wide diversity in accounting practice among municipal water utilities. Most, if not all, privately owned water properties are under the jurisdiction of state regulatory bodies and follow accounting practices prescribed by such authorities.

It appeared from the discussion that there is little uniformity among water departments in regard to the use of a standard accounting system such as that prescribed by the National Association of Railroad and Utilities Commissioners or as suggested in the Manual of Water Works Accounting, published by the Municipal Finance Officers Association and the A. W. W. A. It was also apparent that the same lack of uniformity exists in regard to the handling of annual retirement or depreciation charges, and the creation of a retirement or depreciation reserve.

Depreciation losses are of such great importance in determining cost of service, adequacy of rates, etc., that it was decided to make an attempt to ascertain, as nearly as possible, how depreciation is being handled in present-day accounting practice among municipal water utilities. A questionnaire was sent out to some 275 cities, and 145 (or slightly over 52.5 per cent) were returned with pertinent information. This is believed to be a very satisfactory response, particularly now when time is invaluable and some research may be required to answer them. The information obtained is enlightening. The following table shows the number of cities reporting for several ranges in population:

The Author

Population	No. Reporting
Under 25,000	43
25,000 to 50,000	35
50,000 to 100,000	26
100,000 to 150,000	11
150,000 to 200,000	7
200,000 to 300,000	7
300,000 to 400,000	6
400,000 to 500,000	2
500,000 to 750,000	3
750,000 to 1,000,000	3
Over 1,000,000	2
Total	145

The geographical distribution of the 145 cities reporting is shown in the following list:

State	No. Reporting	State	No. Reporting
Arizona	1	Nebraska	5
Arkansas	1	New Hampshire	2
California	9	New Jersey	4
Colorado	4	New York	4
Connecticut	2	North Carolina	1
Florida	4	North Dakota	3
Idaho	2	Ohio	3
Illinois	7	Oklahoma	3
Indiana	2	Oregon	2
Iowa	7	Pennsylvania	2
Kansas	8	South Carolina	2
Kentucky	2	South Dakota	1
Louisiana	1	Tennessee	4
Maine	2	Texas	7
Maryland	2	Utah	1
Massachusetts	4	Virginia	3
Michigan	7	Washington	4
Minnesota	4	West Virginia	1
Mississippi	1	Wisconsin	10
Missouri	6	Wyoming	1
Montana	4		

The information received is representative geographically, but to a lesser extent as to the size-range of cities, because of lack of specific reports from the smaller municipalities. The data can, however, be considered as representative of average practice in the larger cities of the country.

The questions asked in the questionnaire were:

1. Do you make an annual charge to operations for retirements (annual depreciation charge)?
2. If so, how is amount determined?
3. What is the book value of depreciable property in your system? (Total of physical property exclusive of land.)
4. What is amount set aside each year for retirement or depreciation?
5. What is the present balance in your retirement or depreciation reserve account?
6. Do you carry an actual cash reserve for retirements or depreciation, or do you carry merely a book figure, the money being used for plant extensions?
7. Do you keep books in accordance with any standard system of accounts such as that outlined in the A. W. W. A. Manual of Water Works Accounting, or that of the National Association of Railroad and Utilities Commissioners? Name?
8. Have you ever had your system appraised to determine its actual cost, and the total amount of accrued depreciation existing in the system?

Replies

Answers to question No. 1 show that out of the 145 cities reporting, 107 or 73.8 per cent make an annual charge to operations for depreciation.

*Note: A paper, written originally for *Water Works and Sewerage*, the publication of which has been delayed in order that this analysis of depreciation accounting practices might be first presented before the 1944 AWWA Conference in Milwaukee. By arrangement, it is being published simultaneously in *Water Works and Sewerage* and the AWWA Journal.—Ed.

Answers to question No. 2 indicate that approximately 70, or 65 per cent of the 107 cities making such annual charges for retirement or depreciation, calculated the amount by applying an annual percentage rate to the total book figures for each of the major accounts or like groups of property. The other 37 cities used various methods, some applying a fixed percentage to the entire capital account shown in the books, while others applied it to the depreciable property portion of the total capital account only. Some of the cities use a flat figure annually, the amount varying in some cases from year to year. Others used some modification of the different methods mentioned above.

Twenty-five cities out of the total of 70 cities that apply an annual rate to major accounts reported the annual rates used. These are summarized as follows:

PERCENTAGES USED IN DETERMINING ANNUAL ALLOWANCE FOR RETIREMENT OR DEPRECIATION

Class of Property	Percentage Annual Allowance for Depreciation		
	Minimum	Maximum	Average
Structures:			
Buildings	1.33	3.0	1.98
Dams and tunnels, etc.	0.80	1.0	0.90
Wells	3.00	7.0	3.94
Pumping equipment	2.00	10.0	4.37
Mains—cast-iron	0.67	2.0	1.29
Valves	1.00	2.0	1.52
Services	1.50	6.5	3.21
Meters	2.00	10.0	4.21
Hydrants	1.33	5.0	1.99
Furniture and fixtures	3.00	10.0	7.61
Transportation equipment	10.00	25.0	17.60

The percentages listed above were probably determined by several different methods, but the amounts indicate a mixture of sinking-fund and straight-line rates, the latter being more predominant. The average composite annual rate, expressed as a percentage of depreciable property for 100 of the 107 cities making annual allowances for depreciation, was approximately 1.77 per cent per year. This is, generally speaking, higher than composite rates allowed by regulatory commissions in determination of rates for private companies. As the above rate of 1.77 per cent is a weighted average of all of the 97 cities, inference should not be made that all of the rates applied are too high. As a matter of fact, all data obtained from this survey should be considered as average mass data, and indicating only the general and average situation, and should be applied to individual cases only on that basis.

Answers to question No. 3, in regard to book value of depreciable plant, show that the total book value of depreciable property in all of the 107 cities maintaining a depreciation reserve and making annual allowances for retirement or depreciation, is $1,047,000,000. This represents 77.8 per cent of the value of depreciable property in all of the 145 cities reporting, which amounts to $1,346,000,000. The total book value of depreciable property in cities where no reserve is maintained for retirement or depreciation is $299,600,000, or 22.2 per cent of the total in the 145 cities.

Per Capita Book Value

The population in the 107 cities which maintain retirement or depreciation reserves was, as of 1940, 13,986,182, or 76.1 per cent of the total for all 145 cities of 18,383,826. The average per capita book value of depreciable property in these cities is approximately $75. The population of the 38 cities in which no retirement or depreciation reserve is carried on the book was 4,397,644, or 23.9 per cent of the total population of all the cities reporting. The average per capita book value of depreciable property in this group of cities is approximately $68.

The reasons for the difference in per capita book value of the two groups of cities is not clear but may be due to a greater cost of supply works in the larger group and to some extent to the accounting practice of both groups. The above figures indicate clearly that the data obtained in the survey are influenced by practice in the larger cities. The recognition of the need for making charges for retirement or depreciation, and creating a reserve for that purpose, would be even less general in the smaller cities, which make up the majority of the total number of water utilities in the country, than in the larger ones represented in this survey.

Answers to question No. 4, regarding the amounts set aside each year for retirement or depreciation, totaled for 97 of the 107 cities reporting such charges, $17,747,607, or 1.77 per cent of the total book value of depreciable property in the same cities. This percentage (1.77 per cent) represents the average of all 97 cities, and many of them have individual annual allowances much higher. As a matter of fact, the composite figure of 1.77 per cent is considerably higher than the composite percentage used in a number of cities which are following schedules recommended by their state regulatory body.

Answers to question No. 5, in regard to the amount of balances in the retirement or depreciation reserve, show that the total of all balances for 100 of the 107 cities having such balances is $254,297,972, or 27 per cent of the total book value of depreciable property in those cities. The retirement or depreciation reserve of 27 per cent indicates unnecessarily large reserves, a subject which will be discussed later.

Answers to question No. 6, regarding the character of the reserve, i.e., whether merely a book figure, the cash being used for extensions or debt retirement, or whether an actual cash reserve, show that of the 107 cities reporting, 16 cities carry the reserve as cash, 87 cities carry the reserve as a book figure and 4 cities do not state how the reserve is handled. Approximately 84.5 per cent of those cities reporting an annual retirement of depreciation allowance carry only a book figure for the reserve, the money being used for replacements and extensions or for debt retirement.

Among the 107 cities carrying a retirement or depreciation reserve, there are three commonly used methods in which accounting for depreciation is shown on the balance sheet. These methods are:

1. The inclusion of the total capital investment in the property as an asset, the liability due to accrued depreciation being shown as a reserve for depreciation under liabilities.

2. The inclusion of the total capital investment in the property as a sub-total under assets from which is deducted the accumulated reserve for depreciation, the net remaining capital investment then appearing as a net asset in the total assets.

3. The inclusion as a net asset of the net remaining capital investment after depreciation as of the date of the balance sheet, no reference being made to the accrued amount or annual rate for depreciation.

Methods 1 and 2 give a complete and true statement of the financial position of the property so far as physical plant and the reserve are concerned. Method 3 does not show a complete record of physical plant costs and in case the accruals to the reserve (deductions from capital investment) are either too small or too large, the statement of plant account is also respectively too large or too small. The plant account should be corrected annually to reflect actual additions and retirements, and not be influenced in total by the retirement or depreciation reserve. The determination of the adequacy to the reserve will be discussed later in this paper.

Answers to question No. 7, re-

garding system of accounts used, indicate that 90 out of the 145 cities reporting, or 62 per cent, are using some standard bookkeeping system such as that prescribed by the NARUC, the Manual of Water Works Accounting or by their respective state regulatory bodies. Certain others are using some modification of some of the above mentioned systems, set up by their accountants or auditors.

Lack of Uniformity

It is apparent that there is a decided lack of uniformity in accounting practices in the 145 cities reporting and that it would be desirable to have all water utility properties operating at least reasonably close to some standard uniform system of accounts. Unless some uniform system of accounting is adhered to, it is impossible to make an intelligent comparison of costs and other statistical data involved in the accounting.

Since a majority of the cities that are following some standard uniform system of accounting are using that of the NARUC, for adaptations thereof by state regulatory bodies, it would seem that this would be a good system for cities to adopt if a change is made. The use of an expert accountant versed in utility accounting is always desirable, particularly in setting up a system of accounts.

Answers to question No. 8 show that 52 of the 145 cities reporting, or approximately 36 per cent, have had appraisals made of their property. The greater part of these had been made at the time of acquisition. Very few appraisals or determinations of the actual accrued depreciation existing in the respective systems had been made in the last 10 years.

The information obtained from the survey covered in the preceding paragraphs is summarized in Table I.

Before analyzing the facts disclosed from the survey in regard to the adequacy of annual allowances and reserves for retirement or depreciation, it would be well to review the definition of depreciation and the reasons for accounting for it.

Depreciation has been defined as "the loss in service value not restored by current maintenance." Among the general causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the art, changes in the demand and requirements of public authorities. The combined effect of such causes is called depreciation.

TABLE I

SUMMARY OF DATA OBTAINED FROM SURVEY

		Pct. of Total
(1) Cities making annual charge for retirement or depreciation and having a reserve	107	73.8
(2) Cities not making annual charge for retirement or depreciation and not having a reserve	38	26.2
Total number of cities reporting	145	100.0
Total number of states represented	41	85.4
Total book value depreciable property in (1) above (107 cities)	$1,047,000,000	77.8
Total book value depreciable property in (2) above (38 cities)	$ 299,600,000	22.2
Total book value depreciable property in all cities reporting (145 cities)	$1,346,600,000	100.0
Population (1940) of cities in (1) above	13,986,182	76.1
Population (1940) of cities in (2) above	4,397,644	23.9
Total population (1940) of all cities reporting (145 cities)	18,383,826	100.0
Total amount of retirement or depreciation reserve in (1) above (includes 100 out of 107 cities)	$ 254,297,972	
Ratio of reserve to depreciable property in (1) above (includes 100 out of 107 cities), *percentage*	27	
Total amount of annual allowance for retirement or depreciation in (1) above (includes 97 out of 107 cities)	$ 17,747,607	
Ratio of total annual allowance to total depreciable property in (1) above (includes 97 out of 107 cities, *percentage*	1.77	
Percentage of (1) (107 cities) basing annual retirement or depreciation allowance upon percentages applied to major accounts or like groups of property	65	
Percentage of (1) (107 cities) carrying retirement or depreciation reserve as book figure only	84.5	
Percentage of (1) above (107 cities) carrying cash retirement or depreciation reserve	15.5	
Percentage of (1) above (107 cities) using some standard system of uniform accounting	62.0	
Percentage of total cities reporting (145 cities) having had systems appraised	36.0	

Causes of Depreciation

The general causes of depreciation have been logically classified into two general groups by Marston and Agg.* This classification as given by the above authority is:

(1) Physical Causes
  (a) Sudden physical damage, due to
    1. Miscellaneous accidents
    2. Disasters
  (b) Physical decrepitude, due to
    1. Physical deterioration, due to action of the elements, etc.
    2. Wear and tear

(2) Functional Causes
  (a) Functional inefficiency, due to
    1. Inadequacy
    2. Obsoleteness
    3. Supersession

The division of causes of retirement into physical and functional is a natural one, as the service life of any unit of property may be, and usually is, determined by one independently of the other.

Depreciation is generally recognized as an increment of cost in all commercial business where physical property is involved. In the utility field, physical property constitutes a major part of the investment required to produce and distribute the commodity sold or the service rendered; therefore, it is especially important that the matter of depreciation be considered in the accounting connected with such enterprises.

The cost of service in any utility includes, among other things, materials used up in service. These materials include not only fuel, such as coal, oil or gas, but also physical property such as pumping stations, distribution mains, etc., the cost of which includes an increment of labor required to place them in service. In the case of the fuels mentioned, it is easy to get the actual cost of the material used up in service, and very properly such costs are included in routine operating expenses.

The value of physical property such as that involved in pumping stations, pumping equipment, distribution mains, etc., is used up in service just as the fuels mentioned, although their consumption takes place over much longer periods, individual items having different lengths of service lives. Nevertheless, the portion of the service value of such items used up in service each year should be charged to operating expenses and made an increment of the cost of the commodity furnished, which is water in the example under consideration. This can only be done by accounting for depreciation. The setting up on the balance sheet of a reserve for the accrued depreciation existing in the property is in accord with the method of double-entry bookkeeping on the accrual basis which gives a complete and true picture of the financial position of the utility.

That depreciation takes place is a matter of common knowledge. It seems also as apparent that it should be considered as part of the cost of service, and that such increment of the total cost should be reflected in rates charged for the commodity sold. It has been and now is so considered by courts and commissions

*Marston, Anson & Agg, Thomas R. Engineering Valuation. McGraw-Hill Book Co., Inc., New York and London (1936).

in the regulation of rates, and it is surprising that such a large number of cities do not consider the item of depreciation as an element of operating costs.

Plan for Depreciation

It is frequently stated that a city that is retiring its indebtedness does not need to take account of depreciation. There is enough apparent justification for such a statement to make it seem reasonable, although the premise is illogical. Assuming the money used for debt retirements comes from revenue, and that the annual amount of such retirements equals or exceeds the annual amount of depreciation accruing, it is true that the customers are contributing through rates paid for service an amount equivalent to a charge for depreciation.

Therefore, from the standpoint of adequacy of rates, the statement that if indebtedness is being retired, depreciation does not have to be accounted for, may be partially correct. It would be better practice, however, to carry a depreciation reserve and also a reserve for extensions and debt retirements on the books, the cash being applied to replacements, extensions or retirement of debt. Such a plan would allow the book records to reflect the true financial condition of the property at any time. The practice of not accounting for depreciation makes the statement of the financial position of the utility inaccurate.

Many cities have financed water systems from proceeds from general obligation bonds, and the interest and retirement charges are paid from funds acquired by taxation or by contributions from the water department to the general funds, or from both sources. Many such cities make no accounting for depreciation, nor do they keep books on any standard system of accounting.

It would be much better if some uniform system of accounting were adopted by means of which depreciation and other items are accounted for in a proper manner. Under such a plan, the utility accounting can be maintained on a basis that reflects the true financial condition of the utility, and one that is not influenced by the debt situation, which varies among cities and changes from year to year in each system.

Regardless of the debt structure, the utility accounting can be on a proper basis, the contribution of funds to meet debt obligations being made by cash from any reserve funds created. The point is that the accounting, so far as the utility is concerned, should be based upon the operation of the utility itself, and not governed by the financial situation that may exist as to debt service.

As stated above, it is common knowledge that depreciation in any physical plant does take place, and it would seem to be as apparent that the loss in service value due to it should be accounted for and made part of the cost of service. The determination of the proper amount to charge operations each year due to depreciation losses is not a simple one.

The rate at which materials and equipment depreciate or suffer loss in service value differs in all utility systems. This is true so far as physical causes are concerned and to a much greater extent from those of a functional nature. A water system in a rapidly growing city will usually have more accruing losses in service value than one of slower growth. This is due to the fact that pumps, mains and other units of property become inadequate more quickly due to increased demands.

Similar units of property may, and usually do, have different useful service lives in different systems. Unless a system has grown and is continuing to grow at a steady rate and has reached an age equal to that of the unit of property having the longest useful service life in that particular property, and it can be assumed that there will be no unusual changes in the art, any data taken from the records upon which annual losses due to depreciation could be based, would not be accurate. No property in the water utility field would provide such information.

There are at present several theoretical methods in use for estimating the annual rate of accrual of depreciation and for which equivalent annual allowances are usually made. The most commonly used methods are:

1. Straight-line method.
2. Sinking-fund method.
3. Service - life - present - worth method.

The above methods call for establishing useful service lives for the different units of property involved, which at best can only be approximately correct. These service lives are usually taken from some table based upon average figures or what may appear to be average figures from some one or a few particular systems. Such average service life figures may not even approximate the actual service life of the different units in the particular property for which annual allowances are being determined.

Any one of the above methods might be used as a basis for annual allowances for depreciation if the results are checked frequently and adjusted in accordance with actual accrued depreciation. The straight-line method does not give results consistent with the facts, however, since the service value of utility property does not diminish as a straight line. The sinking-fund and service-life-present-worth methods, while differing in theory, do not differ materially in results, and both recognize that, while a certain portion of the useful life has elapsed, the remaining service value is greater than indicated by the ratio of age to the estimated useful life.

It is apparent that a depreciation reserve established in accordance with these theoretical methods, if not checked against an engineering determination of the actual existing accrued depreciation, may soon become considerably greater or less than it should be.

Allowance for Retirement

Fortunately, these allowances which are made annually can be varied and the correct answer as to the correctness of the annual allowances is a periodic engineering determination of whether the balance in the retirement or depreciation reserve is adequate to cover the depreciation that has accrued in any particular system at some fixed date. It is possible to make, within reasonable limits of accuracy, an engineering determination of the existing accrued depreciation at any certain time, based upon conditions prevailing at that time.

Conditions may change later and cause the rate of diminution of service value either to increase or decrease, but for any current date a reasonably accurate measure can be obtained for testing the adequacy of the reserve. If the amount is greater than needed, the annual allowances can be reduced, or if inadequate, they can be raised. Such a check, made periodically, gives a logical and practical method of determining what such allowances should be, as well as checking the adequacy of the reserve.

The determination of proper annual allowances for retirement or depreciation and the adequacy of a retirement reserve are, from their very nature, engineering problems. Engineering appraisals of physical property are helpful in setting up a proper system of accounts, and an

engineering determination of accrued depreciation is the best and only real means of knowing the actual amount of accrued depreciation existing at any fixed date.

What the depreciation reserve really represents is the amount of depreciation that has taken place in the property still in service, or, expressed another way, the property that has been used up in service and for which the utility has been compensated for through rates. While it is not necessary to hold the retirement or depreciation fund in cash, as it is usually more prudent to use the money for plant extensions or debt retirement, it still is, in principle, a trust fund, held to replace the used up property when retired and for which the consumer has already paid. It is evident that depreciation charges that are greater than actually needed would, if reflected in rates, place a greater burden on the consumer than is necessary or fair. Likewise, charges that are too low would be unfair to the utility.

The data obtained from the survey discussed above show that, in 107 cities recognizing depreciation in their accounting system, the total reserves in these cities is equal to 27 per cent of the total of depreciable property. This means, if that amount were justified, that 27 per cent of the depreciable physical plant still in operation had been used up in service, or, stated in another way, the physical plants have an over-all average physical and functional condition of 73 per cent.

As the figure of 27 per cent is an average, some of the systems have much larger reserves. It is believed that none of the plants reporting are in such low condition, as service would probably be impaired if they were. Most of the reserves in this group of cities appear to have been influenced largely by straight-line methods of determining annual allowances. It is a good example of why the straight-line method is, as generally applied, too drastic and also illogical when compared to what actually takes place in the long-life properties. This is especially true of most water works properties. While it is good practice to have a reasonable excess in the reserve to take care of unusual and unexpected retirements, it is believed that in those 107 cities quite a number have been accumulating reserves at a rate in excess of actual requirements.

Many water departments are faced with demands for transfer of cash to other city funds. Many of these departments could avoid serious depletion of funds if their accounting system recognized depreciation and if an adequate book reserve were maintained for retirement or depreciation, as well as an adequate cash reserve for extensions or debt retirement.

Many cities carry large depreciation reserves in order to hold funds in the water department, which purpose is often justified; but it is believed that equal protection would be available through other reserve funds and the accounting be made more accurate thereby. A city may have the legal right to use funds from its utility department for other departments, but it should not do so unless the utility, by proper accounting, is shown really to have excess funds.

If such excess funds exist, it would seem proper to reduce rates rather than divert funds to other departments, as such practice is really indirect taxation. Utility department officials should insist on keeping the department sound financially and resist as far as possible the transfer of needed funds, which practice is followed in many places to the serious detriment of the department.

A notice has just appeared in the press which states that in one fairly large city water rates are to be boosted 33⅓ per cent, the increase being made to provide funds for postwar improvements, including a sewage disposal system, with, perhaps, a water softener and filter system. If the people in this city know all about what is to be done with money raised in this manner and are willing to be so taxed for it, the city no doubt has the right to adopt such a plan, and the case is only mentioned as an example of the use of utility funds for other departments.

It is hoped that soon all the water departments in the country will realize the advantages of following a uniform system of accounting and a universal recognition of the necessity of including in such systems the proper accounting for depreciation.

"Bill" Bailey Takes His Life

Friends of William T. Bailey of Kansas City, Mo., were shocked to read on the front page of the Kansas City Times of July 19th, that he, the evening before about 8 o'clock, after having had mysterious telephone conversation which ended up by his saying, "Well, that's the way it goes—that's the way it is!", had gone into the bathroom and taken a lethal dose of poison. What poison, was not reported.

"Bill" Bailey was 43 years young. He came to Kansas City from Council Bluffs, Ia., where he had been Supt. of Filtration and Pumping, and became Supt. of Filtration at the new Kansas City softening plant in April, 1942. In August of 1943 he was promoted to the position of Chief Engineer and Supt. of the entire K. C. water system, succeeding Melvin P. Hatcher, who became Director of Water. So, he had progressed rapidly since leaving Council Bluffs and his services had been completely satisfactory to his superiors, according to the Kansas City authorities. Why he took his life is still a baffling mystery.

"Bill" Bailey was born in Kirksville, Mo., Nov. 6, 1900 and was graduated in 1927 from the University of Iowa, where he was made a Phi Beta Kappa. He was a past chairman of the Missouri Valley Section of AWWA which voted him the AWWA Fuller Memorial Award for conspicuous achievement. In Council Bluffs he was president of the Rotary Club. He had contributed several articles to "Water Works & Sewage" and at the time of ending his career so inexplicably had an article on the handling and feeding of water supply chemicals under preparation. At Kansas City he had introduced some novel operational methods which markedly reduced coagulation and softening costs. As his bosses put it, his work had been completely satisfactory and he had shown no reasons at work or in his home life to account for the abrupt ending of a highly useful career and public service by one, considered by us a splendid citizen therewith.

"Bill" Bailey

"Bill" Bailey leaves a young widow without children, and a Water Department which will feel his loss. When he left work that last afternoon he said to his associates—"I am going home to get some rest."

DOLLARS AND SENSE OF DEPRECIATION*

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DEPRECIATION and retirement of physical property, like death in humans, is inevitable, and, like human experience, mortality of utility equipment is influenced by the characteristics of each individual property, its physical constitution, environment and the hazards inherent in the service which it performs. Also, utility properties, like the human race, do not expire in toto. They, too, are continuing enterprises even though, like individual human beings, their plant items are subject to finite life. With improvement in the art, utility property items, like humans, have an increasing life expectancy and where new additions are constantly being made and old-age items being retired, the over-all composite ages of both utilities and the human race are growing but slightly and certainly not in parallel with the passage of time. With both humans and utilities it is practicable to set up annuities (or annual depreciation allowances), but in neither case does the accumulation in the reserve fund precisely represent the accrued depreciation of an individual person or property.

Although the existence of depreciation is universally admitted, the extent to which it is present and the most practicable means of measuring and financing it are highly controversial.

Recently, renewed attention has been directed to the question of depreciation as a result of a report prepared by the Committee on Depreciation of the National Association of Railroad and Utilities Commissioners. The recommendations and implications of this report are of such vast import to all utilities and especially to the long-lived water utilities as to warrant the most serious consideration.

The Board of Directors of the American Water Works Association, at its January, 1944, meeting, approved the appointment by President Morris of a special Depreciation Committee to study the NARUC report with special reference to its application to the water utilities.

The Author

The committee completed its report late in April. It was approved by the A. W. W. A. Executive Committee and filed with the NARUC Committee before April 30, the final date set by that committee for the receipt of discussions of its report. (The committee's report was published in the June, 1944, Journal of the A. W. W. A.)

The NARUC report covers some 275 printed pages. With much of it there is rather universal agreement. It contains, however, some recommendations at wide divergence with past procedure, only the most important of which will be discussed.

Highlights of NARUC Report

The major items to which your attention will be directed in this discussion are:

1. A fundamental divergence in the definition of depreciation as stated in the NARUC Committee report from present legal and generally accepted procedure, even that of NARUC's own Uniform Classification of Accounts.

2. The recommendation that the "straight-line" method be used both for setting up annual depreciation allowances and for determining accrued depreciation.

3. The statement that the reserve computed on the straight-line basis *is the actual* depreciation in the property.

4. The recommendation that the depreciation reserve be increased to that computed on the straight-line basis by charge to surplus or otherwise.

Definitions

The principle of depreciation has nowhere been better stated than by the U. S. Supreme Court in the Knoxville Water Co. case (*Knoxville* v. *Knoxville Water Co.*, 212 U. S. 1) in 1909:

> A water plant, with all its additions, begins to depreciate in value from the moment of its use. Before coming to the question of profit at all, the company is entitled to earn a sufficient sum annually to provide not only current repairs, but for making good the depreciation and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste, without making provisions out of earnings for its replacement. It is entitled to see that, from earnings, the value of the property invested is kept unimpaired, so that, at the end of any given term of years, the original investment remains as it was at the beginning. It is not only the right of the company to make such a provision, but it is its duty to its bond and stockholders, and, in the case of a public service corporation, at least, its plain duty to the public.

Following that decision it has been almost the universal practice of utilities to set aside from revenue each year an amount sufficient to cover the item of depreciation during that year.

There are various concepts of depreciation. Possibly the best legal definition is that of Mr. Chief Justice Hughes in the Lindheimer case (292 U. S. 151), as follows:

> Broadly speaking, depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy and obsolescence. Annual depreciation is the loss that takes place in a year.

The NARUC Uniform System of Accounts states:

> "Depreciation," as applied to depreciable utility plant, means loss in service value not restored by current maintenance incurred in connection with the consumption or prospective retirement of utility plant in the course of service, from causes which are known to be in current operation and against which the utility is not protected by insurance. Among the causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the art, changes in demand and requirements of public authorities.

The present report of the NARUC Committee on Depreciation diverges materially from these definitions which to date are the law of the land. The definition in this new volume reads:

> 2. The significance of the depreciation phenomenon may be described as follows:
> (a) Depreciation is the expiration or consumption, in whole or in part, of the service life, capacity, or utility of property resulting from the action of one or more of the forces operating to bring about the retirement of such property from service;
> (b) The forces so operating include wear and tear, decay, action of the elements, inadequacy, obsolescence, and public requirements;
> (c) Depreciation results in a cost of service.

Careful comparison of the legal definitions and that of the NARUC Depreciation Committee shows that, whereas the earlier definitions refer to loss in *value* not restored by cur-

*A paper presented before the A.W.W.A. Annual Conference, in Milwaukee, Wis., and herein reproduced by permission of the Association.

rent maintenance, that is now superseded by "consumption in whole or in part of the service *life*, capacity or utility of property." Depreciation under this new definition becomes a question of consumption of *life* rather than of *value*. Depreciation as developed in the NARUC Committee report is, in fact, amortization of original cost on a straight-line basis and bears no relation to the actual facts of depreciation. The *Encyclopedia Britannica* defines depreciation as "inevitable wastage in the value of assets," and amortization as "liquidation or extinguishment of an asset by means of a series of partial payments prorated to extend over the period during which the asset will exist." Depreciation and amortization are not synonymous. It is depreciation with which water works properties are concerned.

Depreciation Accounting

Depreciation occurs and must be financed irrespective of whether the water works are municipally or privately owned, although the factors affecting depreciation accounting methods and policies are frequently influenced to some extent by the ownership.

In only a few states are publicly-owned utilities subject to regulation. Their depreciation methods and policies are, therefore, largely determined locally. Publicly-owned water utilities in general set up larger depreciation reserves than the private companies and ordinarily use the straight-line method for annual allowances. The reserve thus accrued frequently bears no direct relation to the actual accrued depreciation of the property. This policy of liberal reserves provides funds required for plant additions and obviates delays and costs incident to bond issues otherwise necessary.

Most privately-owned utilities are operated under governmental regulation and the annual depreciation allowance is either fixed or approved by the regulatory body. Their accrued depreciation and present value are usually checked at more or less frequent intervals in studying the fairness of rates for service. As a result of several decades of regulation, the privately-owned utilities usually maintain a closer balance between annual and accrued depreciation and the actual requirements for each property.

Inquiry from a large number of municipally-owned water works by N. T. Veatch has disclosed that on an average of 107 cities, the amount set aside annually for depreciation was equal to 1.77 per cent of book cost and the accumulation in the reserve averaged 27 per cent of the book cost. Recent analysis of the figures from 181 privately-owned water works shows that the average annual rate of depreciation is 0.99 of 1 per cent of the book cost and the credit balance in the depreciation reserves averages 13.4 per cent of the book cost. The average amount of the surplus account of the 181 properties was equivalent to 6.25 per cent of the book cost.

It may appear that the NARUC Committee report and this discussion apply only to privately-owned utilities, but such is not the case. As state regulation of publicly-owned water works becomes more universal, the impact of the NARUC depreciation policy on the publicly-owned plants will become apparent. Rates fixed upon a rate base resulting from the deduction for depreciation in amount in excess of that actually existing will handicap the municipal utilities in financing future expansion. This will be particularly true where bond issues are required.

If the NARUC committee method of depreciating a property is followed, a newly acquired municipal plant, financed by revenue bonds of 40-year maturity with equal annual payments for interest and principal, will depreciate at a rate faster than the bonds are retired for the first 10 years after acquisition, thus impairing the equity behind the bonds.

Annual vs. Accrued Depreciation

It would seem to be self-evident that annual depreciation allowances and accrued depreciation should be reasonably in harmony. The only purpose of annual depreciation allowances is to provide for accrued depreciation as and when it occurs. The NARUC Committee report states that straight-line depreciation should be used for both annual and accrued depreciation determinations. As to these views, the report of the A. W. W. A. Depreciation Committee states:

> Our group has no disagreement with the general principle that accrued depreciation and annual allowances must be reasonably in step. We do disagree completely with the applicability of the straight-line theory in the determination of accrued depreciation of long-lived water works structures. We hold that the accrued depreciation reserve must be closely related with the facts of depreciation and most water works property does not depreciate in a straight line.

Accrued depreciation is a fact. It is either there or it is not; and if it exists, the extent to which it exists is also a factual matter. Annual depreciation is simply a means of financing that fact in the amount and at the time it occurs. No method of financing can add to or detract from the amount of actual depreciation which a property has suffered. In the report of the NARUC Committee it is stated that if the sinking-fund method of computing depreciation expense is used, no accrued depreciation should be deducted in fixing the rate base.

The fact that the annual allowance has been set aside by the sinking-fund method cannot in any way affect either the actuality or the amount of depreciation which has accrued on the property. It can only affect the accounting. Similarly, the assertion which the report reiterates so frequently—the actual depreciation is determined by the amount of the depreciation reserve computed on the straight-line basis—is equally unsound. That, too, is only an accounting procedure. The charge entered on the books cannot possibly affect the physical condition of the property. Under the NARUC Committee's theory two identical properties, one of which sets up depreciation on a sinking-fund and the other on a straight-line basis, would have different values. The actual depreciation is independent of the method by which it is financed.

The NARUC Committee report states that the straight-line method should be adopted because it is simple and less affected by errors than other methods. Is that true as applied to the long-lived water utility? Actually, straight-line depreciation is based wholly on estimates. First, it involves an estimate of the life expectancy of each property unit. Of course, that estimate is easily made for short-lived units like electric light bulbs, telephone instruments, railroad ties or electric power line poles which have already passed through several life cycles. But what is the life of cast-iron pipe, which makes up about two-thirds of the value of the average water works? Is it 65 years (as stated in Bulletin F of the U. S. Treasury Department, Bureau of Internal Revenue) for 6-inch pipe (50 per cent of the average system), or is it 100 years, as some commissions and engineers have assumed? Or is it 200 years or 500 years?

In the first 15 water plants studied by the A. W. W. A. Committee on Survival and Retirement Experience with Water Works Facilities there had been installed 34,654,567 lin. ft of 6-in. and larger cast-iron pipe in periods beginning with 1821. Only 1,464,624 ft. or 4 per cent had been removed for all causes and the average survival ratio was 93.1 per cent, with the average experience

record of 66.3 years. Very few cities have removed as much as 5 per cent of the cast-iron pipe laid. Its life will scrap pipe be worth, say, in the tween different systems. Many systems serving 50,000 or more people have practically no retirement experience on which to hazard even a decent guess as to the average life expectancy of its pipe system.

This point is illustrated by the testimony of an old "river rat" in an important flood lawsuit. He was semi-illiterate, 88 years of age, was born and had spent his entire life on a houseboat making a precarious living by salvaging floating timbers from the Missouri River during high-water periods. After testifying freely with a remarkable memory of the flood history of the Missouri during his lifetime on its banks, he was asked whether he remembered the 1881 flood. Upon his affirmative answer the attorney asked him if that wasn't the greatest flood there ever was on the Missouri. The old man replied he did not know and stuck to it. When finally asked why he didn't know in view of his 88 years spent on the river's banks, he replied, "Because I'm not old enough. I wish that some of the depreciation experts were as frank.

After estimating the life of an item such as cast-iron pipe with such accuracy (?), the next step in this simple process is to estimate the net salvage at that far distant future mortality date so that amount can be deducted from original cost to get the depreciation base. What will scrap pipe be worth, say, in the year 2000 or 2100? What will it cost then to remove the pipe? What will labor rates be? What kind of paving will be over the pipe—or will the city be there at all? It is difficult enough to estimate net salvage at the present time. To project that process a century or two in the future is neither simple nor accurate.

This type of simplicity apparently consists in drawing a straight line from an unwarranted assumption to a foregone conclusion. "Actual loss in value not restored by current maintenance" is not influenced by whether that line is straight or curved or what bookkeeping entry may be made.

How Should Accrued Depreciation Be Determined?

Having disposed of the NARUC Committee recommendation, what is the alternative suggested? The A. W. W. A. Depreciation Committee expresses itself on this as follows:

> We believe the proper annual allowance for depreciation on water works structures of long life is arrived at by a careful determination first of the actual depreciation accrued to date, and from that a determination of the annual rate; both the annual rate and the accumulation in the reserve should be periodically reviewed, and the annual allowance adjusted if necessary to bring it into closer harmony with the actual depreciation requirements.
>
> The determination of the actual accrued depreciation involves a careful inspection of the property by one properly qualified through a background of design, construction and operation of similar properties, a careful study of operating and maintenance records, a study of the past and probable future needs for the service which the unit of property performs and its ability to meet them, the history of this unit or property and others of its type under comparable conditions, the presence or apparent imminence of obsolescence and other factors that affect the future usefulness in the particular property being studied.

The NARUC report calls that an estimate. Of course, it is. But the author believes an experienced builder can estimate the condition of this building more accurately than an accountant can forecast how many years it will be here, and certainly the former will more nearly reflect its actual depreciation, which is what we want to know. The amount of accrued depreciation having been determined, the annual allowance should be such that, if accumulated over the years in which the property has been in service, it would have provided the amount so determined in a reserve. This study should be repeated as frequently as necessary, usually at intervals of from 5 to 10 years. When done in this practical manner, the reserve will always be reasonably in step with the annual allowance and the amount in the reserve will reasonably approximate the actual depreciation of the property.

The reserve will usually be somewhat larger than the actual depreciation in the property, for the reason that the annual allowances must reflect the depreciation which results from contingencies and casualties but which is not deductible as actual depreciation until it matures or can be reasonably foreseen. The NARUC report says that the accrued depreciation on a straight-line basis with the assumed life reflecting all casualties whether or not they have occurred *is the actual depreciation.*

This divergence of views is illustrated by the automobile. The fact that the average automobile may sustain a $250 collision damage once in 5 years cannot possibly detract from the value of a car not yet smashed up. The NARUC Committee method, however, would reduce each car's value $50 per year on that account. The annual allowance for depreciation must, of course, recognize the possibility that the casualty will occur, but it certainly is not deductible as accrued depreciation until it actually has occurred.

Similarly, contingencies are not actual depreciation until they mature or can be reasonably foreseen. For example, the annual depreciation allowance in the Cincinnati Water Works should have reflected some provision for the contingency of a flood as high as that of 1937, even though such a flood had not occurred since the inception of the water works more than 100 years earlier.

The accrued depreciation of the Cincinnati Water Works, however, could not and did not reflect that contingency until the unprecedented flood occurred. Under the NARUC Committee report theory 50 per cent of the depreciation which matured with the 1937 Cincinnati flood was actual and deductible from the plant value 50 years before the damage occurred. Preparation must be made in advance for floods, casualties and obsolescence, but that preparation does not mean that there has been any deterioration in the property prior to their occurrence. To hold otherwise seems an incongruous mixture of fact and theory.

All through the NARUC Committee report there appears to be a confusion between fact and theory. The statement that the accumulations in a depreciation reserve by a straight-line method are "actual depreciation," is believed to be inaccurate, misleading and unfortunate. *The proper theory should be made to agree with the facts—not the facts warped to agree with a theory which is in conflict with universally recorded experience.*

Depreciation of long-lived structures and equipment that make up the ordinary water works does not increase on a straight line from the time of installation until the time of removal. The accumulations in a reserve on a straight-line basis for water works property accordingly do not accurately measure the accrued depreciation. They are usually greatly in excess of the demonstrated requirements or the actual depreciation which the reserve is to finance.

Let us apply this NARUC depreciation principle to some of the important water works equipment. In the average water works which has been completely metered for some time, the average age of the water meters is 20 years, more or less. From a practice before many of the state regulatory commissions, the author knows of none using an age-life basis which has given a life to meters of more than about 40 years, and 30 years is frequently used.

On the NARUC Committee report basis the "actual" depreciation of

the average water meter in service is, therefore, approximately 50 to 66.66 per cent. Do any of you water works men believe that your meters are only in 33⅓ to 50 per cent condition? That situation illustrates the effect of the omission of the words "not restored by current maintenance" in the NARUC Depreciation Committee's new definition of depreciation.

The ordinary water distribution system in the Midwest has a weighted average age of between 20 to 35 years. Where commissions use age-life methods of computing depreciation they usually give water mains not to exceed 100 years and mains 6-in. and smaller, frequently shorter lives. In view of the fact that in the average distribution system approximately 70 per cent of the mains are 6-in. and less in diameter, as practical water works men can you agree with the conclusions from the NARUC Committee report that your distribution system is depreciated from 25 to 50 per cent? Is that actual depreciation or unapplicable theory?

Retroactive Adjustment Recommended by NARUC

At various places the NARUC report states that the accumulation in the reserve by a straight-line method is the actual depreciation. In one place the report states: "Where the cost is the gross base then the reserve should be deducted from it in arriving at the rate base, for the reserve alone measures actual depreciation."

The NARUC Depreciation Committee recommends that where the depreciation reserve actually accrued by the companies is less than the amount which should theoretically be in the reserve on the straight-line basis, the reserve should be brought up to the total indicated by the straight-line method by withdrawal from surplus or otherwise.

Practically all privately-owned public utilities have been under governmental regulation for periods varying from 20 to 40 years and their annual depreciation allowances and the credit balances in the reserves reflect the practices either ordered or approved by regulatory bodies. If the recommendation of the NARUC Depreciation Committee should be followed it would mean that the present water utility reserves amounting to 13.4 per cent of book cost would necessarily be increased to from 25 to 35 or 40 per cent in most cases.

Where is this money coming from, in view of the fact that the average water works surplus is but 6 per cent of its book cost? Is there anything fair or equitable in requiring this change in accounting practice and in the valuation and rate base of the utilities? To the author it seems highly unjust and ethically improper to require such a write-down in utility values.

The courts have said that depreciation is a part of the cost of service and as such must be paid by the consumer. In effect, the NARUC Depreciation Committee says to the water utilities: "You must double or triple the amount which regulatory bodies have permitted you to set up, and this excess must be taken from your surplus or by omitting dividends, rather than by collecting it from the rate payers." In the author's opinion there is nothing ethical in that kind of "back-door confiscation."

The NARUC report further states that: "The depreciation reserve should *not* be readjusted gradually through modification of the annual depreciation rates when the difference between the book reserve and the proper service (straight-line) is substantial." With water works this difference is substantial (100 per cent or more of the book reserves) so that this stipulation closes the door to the only means of collecting depreciation costs from the consumers according to law. Not being permitted to collect from the rate payers for the cost of property consumed in their service the difference must be taken from capital and the property values are correspondingly impaired. "Requiring the utilities to deduct from value that which they were never permitted to collect through rates is contrary to all precedent and ethical procedure."

Inventory of Sewerage Needs in U.S.A.

Just published in "Public Health Reports" of the U. S. Public Health Service—Vol. 59—No. 27 (July 7, 1944) is another section of the "National Inventory of Needs for Sanitation Facilities." This section covers needs for "Sewerage Facilities and Pollution Abatement" in the several states.

This inventory of sewerage needs was begun in March, 1943 and is patterned after the "Inventory of Public Water Supply Needs" published in "Public Health Reports" of January 7, 1944 (Vol. 59). It is a projection of sewerage and pollution abatement needs for several years in advance and points out that 2,804 incorporated communities, representing 33% of the total population of the U. S., are so far without any form of sewage treatment. And, it is recorded that 13,915 out of 16,752 communities in the U. S. are in need of additional sewers or sewage treatment facilities, or both. Only 1,300 of the 16,752 communities have what is termed adequate sewerage and sewage treatment facilities. The estimate of costs of providing these needs runs to the astounding figure of $2,255,250,000, of which 46% represents cost of providing treatment plants and 29% the cost of installing new systems. For industrial waste treatment 14% additional expenditure to the municipal sewage and waste treatment combined is the estimated requirement. These cost figures, like the sewerage needs figures, are broken down to show the needs state by state by communities of in various population brackets, but without identifying the individual communities.

Like the U.S.P.H.S. "Inventory of Public Water Supply Needs" this "Sewerage Needs Inventory" is worthy of study as a publication of the potentials in water supply and sewerage needs of the United States and the sections in which the greatest expenditures for such projected improvements are needed.

Copies of "Public Health Reports" of January 7 and July 7, 1944 may be had from the Supt. of Documents, U. S. Govt. Printing Office, Washington 25, D. C., at a cost of only 5 cents per copy.

Sanitary Corps Seeks Additional Sanitary Engineers

The War Dept. has granted the Sanitary Corps authority to commission an additional 211 sanitary engineers in the grades of 2d Lt., 1st Lt., and Captain. Qualifications are a degree from a recognized college or university in civil, sanitary, or chemical engineering; and two years' experience in sanitary engineering for 2d Lt., four years' experience for 1st Lt., and eight years' experience for Captain (for applicants between 38 and 42 years of age).

Further information may be obtained from the Officer Procurement Service Office, located in each Service Command Headquarters, or to the Officer Procurement Service, War Department, Munitions Building, Washington 25, D. C.

ACCOUNTED-FOR WATER AND UNBILLED REVENUE*

A Method for Estimating Both Between Scheduled Meter Readings

By CHAS. E. MOORE
General Manager
ROANOKE WATER DEPARTMENT
ROANOKE, VA.

THE present war has brought forcibly to the attention of the home front the need of conservation of the so-called critical materials.

The War Production Board has fostered a special program in this respect including coal, oil, gas, electricity, communications, water and transportation.

The water department's part in this program may be generally divided into two main features. The first requires that it place its plant in the best over-all condition, the main point of which is to account for all of the water taken from its source of supply and put into its distribution system.

Where communities are served by an unlimited gravity supply requiring no treatment, conservation plays a very minor part. On the other hand if supply is treated chemically and is also pumped, reducing the volume introduced into the distribution system to an economic level produces a saving in chemicals, in fuel, and by their reduction, a reduction in the need for transportation facilities.

The other feature of the water department's part in the conservation program is to educate its consumers to be as conservative in their use of water as is possible.

That water department, which renders its service on a flat rate basis, has no exact measure of the use of its service made by individual customers. It has a peculiar problem that will not be answered by this article which is directed to those plants where practically all customers are metered.

Basic Assumptions

The practice of billing all customers monthly is rapidly being eliminated, and meter readings are now being taken at longer intervals than heretofore. For the purpose of discussion, we may assume that quarterly meter reading has been adopted and, further, that in the interest of economic commercial work one-third of the total customers are billed each month. Two further assumptions are made: That the individual meters serving the customers are read all during the month, and that bills resulting from the meter readings are made and delivered within two or three days after the meters are read.

The Author

Such practice makes the determination of the quantity of water delivered to the customer, as compared with the total quantity pumped, something of a problem. This article undertakes to solve that problem by determining what percentage of the pumpage is actually sold.

The foregoing meter reading practice produces a consumption figure for one-third of the city, closely approximating the total quantity sold for a three-months' period for that entire section as of the middle of the month.

During any quarter period the other two sections have already been billed for a part consumed in the quarter and have also received service of an undetermined quantity for the balance of this quarter. The problem of determining the quantity delivered to all sections, and compared with the quantity of water pumped as of the last day of the month, now presents itself. This article submits for consideration the reconciliation between the water pumped and the water billed by a method of graphs.

Preparation of Chart for Accounted-for Water

Using cross-section paper with a convenient scale, lay out on a vertical axis the total gallons to be pumped for the 14½ months' period beginning with October 15th; on the horizontal scale mark off an equal space representing the 14½ months. The variation in the number of days in the different months will be found to be insignificant and of no real purport. The accompanying figure shows the chart.

At the top of this graph prepare a table of eleven columns as shown. Col. 1 contains the names of the months from December through December inclusive; i. e., 13 months. Column 2 provides for the actual known deliveries of Section 1 for each quarter of the year. Column 3 provides for an accumulative figure of Section 1 to date. Columns 4, 5, 6, and 7 provide for similar figures of Sections 2 and 3 respectively. Column 8 provides for the actual quantity pumped for each month; column 9, the accumulated pumpage. Column 10 provides for the estimate of the water delivered to the customer as taken from the graph; and column 11 is for the determination of the percentage ratio between water accounted for and the water pumped.

Step 1. The first step in preparing the graph is to make an estimate of the quantity of water used by ⅓ of the consumers (i. e., Sect. 1) in the previous quarter as determined from meter readings taken during the month of January. This value is given in Col. 2. Consider that amount as billed the customer as of the middle of January. This is point 1 on the graph.

This estimate is, of course, based on past history. On the graph indicate this quantity by a point half way between the December and the January line.

Step 2. Make a similar determination of the quantities that will be billed for Section 2 during the month of February, and then the third section during the month of March. These are points 2 and 3 respectively, and are the data values given in cols. 4 and 6.

[* Ed. Note: We are indebted to Homer Beckwith, of the Pitometer Co., who directed our attention to this useful method, developed by Mr. Moore and effectively used for some time now in the Roanoke Water Dep't. Realizing the current interest of water utility managers in such a method, we lost no time in persuading Charlie Moore to produce this article for *Water Works and Sewerage.*]

Step 3. Draw on the graph a portion of a line beginning in time three months prior to each point (1, 2, and 3) at zero, and draw the three lines to the end of December only. See heavy lines on graph. It is suggested for convenience that these three lines be drawn in three colors.

Step 4. Add the ordinates of the three lines where they cross the December line and indicate their sum at the end of December by a point, "Est." This ordinate represents your estimate of the water actually delivered as of December 31st. Enter this estimate in the table opposite the top December under Col. 10 "Acct. For."

Step 5. With little or no previous data, you must now assume a factor of accounted-for water and enter on December line under Col. 11. Apply this factor to the "Acct. For" estimate (Col. 10), determine the "Gross" water that has been pumped corresponding to this estimate of water delivered, and enter this pumpage figure on the December line under Col. 9 "Gross."

Step 6. At the end of January, record on the January line in Col. 3 the pumpage for the month of January. Add this value to the Dec. "Gross" in Col. 9 above, and enter the sum on the January line under Col. 9, Gross.

Step 7. When the January billings have actually been determined and corrected to the known unmetered usage, plot this corrected figure half way between December and January (i. e., Jan. 15) and redraw the correct line from zero as of the 15th of October through this point, and project the line to January 15 for point a. Next project the curve on the graph for Sections 2 and 3 to January 31 in the same manner, thus obtaining points b and c on the graph.

Step 8. Now add the three ordinates of the three sections as of January 31 and record on the graph their total, point "A." Reading from the graph, insert this figure in the Col. 10, Accounted-For. This value with the Jan. value in Col. 9 will permit a new determination of the percentage accounted-for to be entered in Col. 11.

Step 9. The process is repeated in subsequent months, and each quarter the estimate previously made is corrected to the known facts. With this initial very close determination of the percentage accounted-for, the succeeding years' graphs will be correspondingly more accurate.

As each month passes, points 4, 5, 6, then 7, 8, 9, etc., will be definitely determined, with points d, e, and f, then g, h, and i, representing the

Col 1 MONTH	Col. 2 SEC. 1	Col. 3 TOTAL	Col. 4 SEC. 2	Col. 5 TOTAL	Col. 6 SEC. 3	Col. 7 TOTAL	Col. 8 PUMPAGE	Col. 9 GROSS	Col. 10 ACCT. FOR	Col. 11 %
DEC								229500	195000	85
JAN	140000						148000	377500	321000	85
FEB			120000				170000	547500	460000	84
MAR					110000		199500	747000	620000	83
APR	200000	340000					241000	988000	820000	83
MAY			200000	320000			297000	1285000	1080000	84
JUNE					200000	310000	268000	1553000	1320000	85
JULY	220000	560000					262000	1815000	1560000	86
AUG			220000	540000			234000	2049000	1760000	86
SEPT					205000	515000	258000	2307000	1960000	85
OCT	200000	760000					245000	2552000	2145000	84
NOV			200000	740000			198000	2750000	2310000	84
DEC					200000	715000	197000	2947000	2475000	84

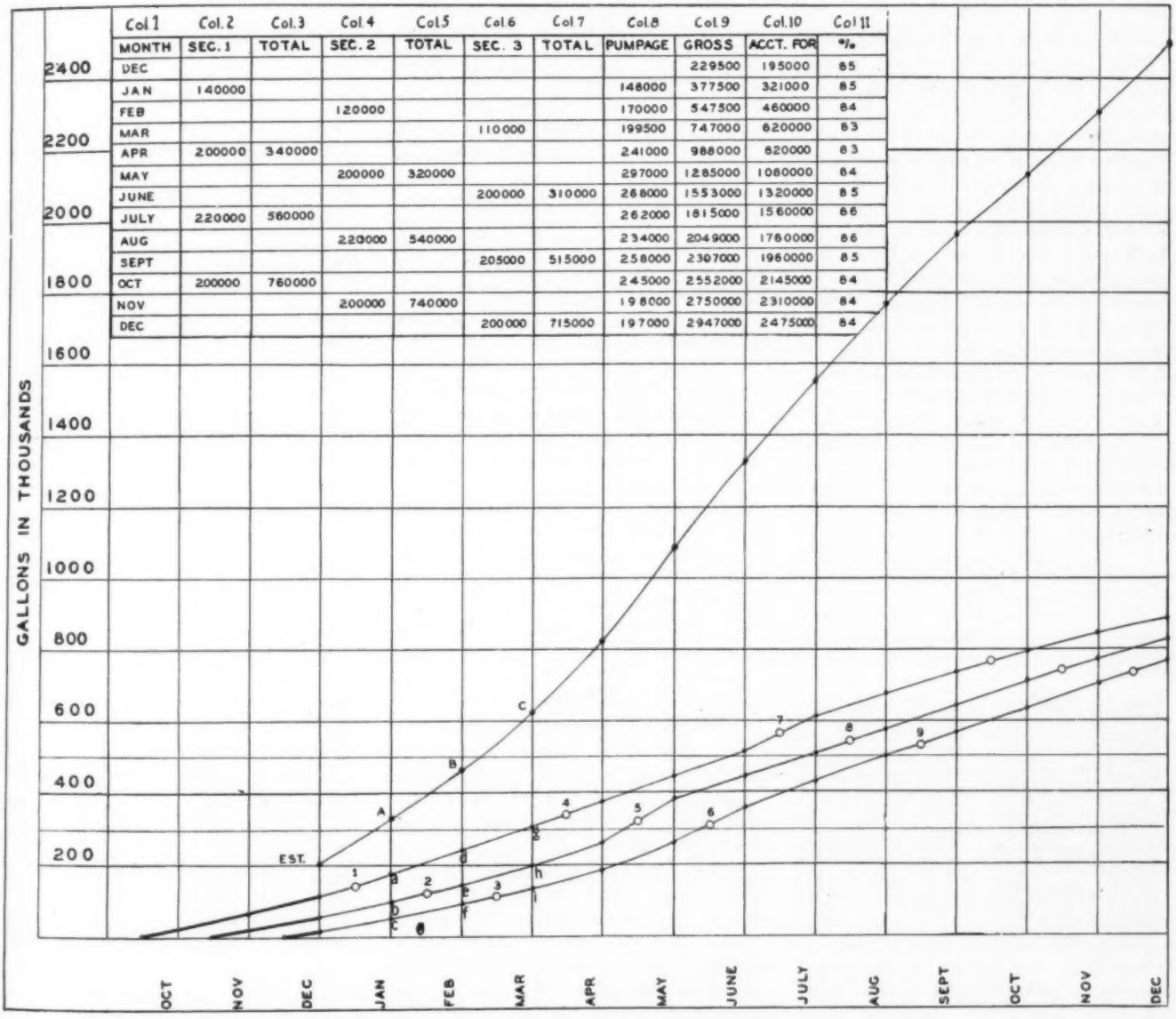

Chart and Table for Determining Accounted-For Water

(See Steps 1-9 *in accompanying text for details of construction—the chart for Unbilled Revenue is developed in the same manner.)*

estimates at the end of each month; the latter groups adding up to B and C, and so on for the year.

It is to be remembered that, while this graph is for the purpose of determining the leakage in the distribution system, it will also include the loss due to under-registration of meters.

Unbilled Revenue

Service to consumers is rendered and costs paid before consumer is billed. Modern accounting practice requires an estimate of the revenue to be derived by a future billing of service already rendered.

The determination of unbilled revenue follows exactly the same fundamental scheme as outlined above. Again use a table of eleven columns. In Cols. 2 to 7 incl. record the regular quarterly billings and the accumulation by quarters. In the subsequent columns, Col. 8, 9, 10, are the accumulated gross billings, the projected revenue, and the difference between the two; that is, unbilled revenue. Col. 11 will show the increase or decrease in this unbilled revenue. (Note, no graph or chart appears herewith for this Unbilled Revenue calculation.)

The curve is started in the same manner as outlined in Step 1 above. An estimate of the revenue for the first three quarters is made, thus determining as of December 31 that portion already delivered for the three sections of the city not yet billed. This is, of course, the unbilled revenue as of December 31 and also equals the projected revenue as of this date.

When monthly billings are known, add the accumulated gross billings in Col. 8, complete the graphs to end of the month in the same manner and upon the same theory as used in the pumpage figures.

The projected revenue determined by the summation of the three alternates is read off the graph and entered in Col. 9. The difference of the two is the new unbilled revenue figure to be entered in Col. 10 with the increase or decrease as the case may be entered in Col. 11. This last column should begin with the low pumpage period, increase to a peak in the high consumption period, and then decrease to approximately its starting point, other general business conditions remaining constant.

It will be found that the time required to prepare these graphs, once they are started and understood, is insignificant. On the other hand the management is possessed of a very accurate determination of the accounted-for water and the relationship between revenue and expense; for, under this quarterly billing scheme and a uniform rate of reading meters, expense of operation will tend to run ahead of actually billed revenue.

Chlorine Supply Short Again

The present scarcity of liquid chlorine for civilian uses has made it necessary for W.P.B. to amend its Allocation Order M-19 covering chlorine. Insofar as the amendments affect procurement of chlorine for water purification, swimming pools and sewage treatment needs the purchaser of chlorine in cylinders of less than one ton are not affected in regard to the permissible use. Purchasers using one ton containers or tank cars are *required* to certify on each purchase order the following "Under par. (C-1-II) M-19."

The two important paragraphs concerning permissive inventory of chlorine, even at water and sewage plants, and "must" requirements in ordering are the following:

"No person shall accept delivery of chlorine if his inventory of chlorine exceeds, or as a result of acceptance would exceed, a 30 day supply on the basis of his current method and rate of operation, unless the amount ordered is the smallest practical delivery unit.

Placing of orders: Each person ordering chlorine from any supplier, should place his order for chlorine on or before the 5th day of the month preceding the period for which delivery is requested if his supplier is a distributor, or the 10th day if his supplier is a producer. No producer or distributor shall be required to fill any order for chlorine which is not placed in accordance with this paragraph."

Our interpretation of this amended chlorine Order M-19 of June 26th is that the smaller chlorine users ordering in 150 or 100 lb. cylinders are not affected by the 30 day supply limit permitted, provided only one cylinder is ordered at a time. In the quoted paragraphs we have underlined this important requirement. Those ordering a number of 150 lb. cylinders must abide by the safe 30 day supply (inventory limit) requirement, as must *all* users of chlorine in one ton containers or tank cars.

The requirement that orders be placed not later than the 5th or 10th day of the month *preceding* that month in which delivery is desired is strongly emphasized, if the user is to be assured of delivery in time to prevent a lapse of chlorination.

For chlorine to be used in water or sewage treatment or swimming pools it is not necessary for the purchaser to file application with the W.P.B., as industrial users are required to do (Form WPB-2908), even though his requirements for any reasonable use may exceed previous requirements. In all cases, however, the order to the chlorine supplier should be endorsed and certified with the wording "Under par. (C-1-II) M-19."

News! Water Rate Reduction

Yes, the Water District authorities of Augusta, Me., made front page news in Augusta when, while everything the folks have to buy there has been going up and up, the Water Utility published the fact that water rates were being reduced. Instead of making new ceilings a la OPA the A.W.D. comes out for making a "new floor" as something different in the course of events.

The reason for this most recent of several reductions in rates over the span of years since Augusta voted to take over the water works for managing, financing and operation under the very effective Maine Water District law is very simple. The charter provides that rates shall be only those required to provide revenue sufficient for operating, maintenance, extension and sinking fund. It says that surplus funds *may* be paid over to the City Treasury. "May" however does not seem to be on the calendar of the Augusta Water District Trustees.

We also have an idea that good management has something to do with the satisfactory physical and financial condition of the Augusta system; because as "Sid" Anthony, Supt., explains, it's partly due to the fact that "we have rebuilt and strengthened much of the system during the past 20 years from earnings and now there is a comfortingly low maintenance and repair expense and a well trained small crew, which really knows how and does a rapid efficient job and has not gone unrecognized or properly compensated by commensurate pay increases."
surate pay increases.

The new water rates in Augusta are per quarter

1st	1,000	cu. ft. @	20c
next	4,000	cu. ft. @	15c
next	10,000	cu. ft. @	12c
next	10,000	cu. ft. @	10c
next	25,000	cu. ft. @	8c
next	50,000	cu. ft. @	7c
all above		@	6c

The minimum charge for domestic service is $4.25 per quarter. Min. charge for 1 fixture in home $1.50 per quarter. Augusta also has a multiplicity of combination fixture rates which lack of space prevents printing here.

AWWA'S PURIFICATION DIVISION SESSIONS AT MILWAUKEE

Reported by
HARRY A. FABER*
Editorial Associate

The Water Purification Division of AWWA held three well attended sessions at the Milwaukee meeting last June. At one of the sessions officers were elected for the ensuing year. The new officers are:

Chairman: Geo. J. Turre, San. Engr., Bd. of Water Comm., Denver, Colo.

Vice Chairman: Cecil K. Calvert, Supt. of Purif., Indianapolis Water Co., Indianapolis, Ind.

Secy-Treas.:. Charles R. Cox, Chief, Bur. Water Supply, Div. of San., N. Y. State Dept. of Health, Albany, N. Y.

Directors: James E. Kerslake, Milwaukee, Wis.; Gordon M. Fair, Harvard University; A. C. Decker, Birmingham, Ala.

A digest of all the papers presented at the three sessions is included in this report.

TECHNICAL PAPERS

"Experiences with Break-point Chlorination," by C. D. Adams, Water Plants Superintendent, Public Service Co. of Indiana, New Albany, Ind.

Four water treatment plants in southern Indiana, three of which operate intermittently and all of which have only one operator on each shift, provided the background for Mr. Adams' discussion. Two plants use the Ohio River as the source of raw water and two use the East branch of the White River. The raw water is heavily polluted with industrial wastes and has a high bacterial content. Daily production of treated water ranges from 0.4 to 4.0 mgd.

A review of operating procedures and results, over a period of several years, showed very few changes in treatment practice save for the amount of chlorine applied and for the methods of control. In general, the amounts of other chemicals required decreased very little. Yet, under present operation, gas-forming organisms are almost completely eliminated from the effluent.

Chairmen

(Retiring)
A. Clinton Decker
Sanitary Engr.
T. C. I. & Ry. Co.
Birmingham, Ala.

(Incoming)
Geo. J. Turre
Sanitary Engr.
Board of Water Comm.
Denver, Colo.

The author classified chlorine treatment into three stages: (1) Its use for disinfection up to 1940, when the break-point reaction was recognized; (2) Its development until 1943, a period of transition while control practices were studied, and, (3) Its development since 1943, when the significance of free chlorine residual was recognized. Originally, the presence of a 0.1 to 0.3 ppm. residual, as shown by ortho-tolidine after 5 minutes, was generally believed to insure acceptable chlorination. Following the recognition of break-point reactions, the flash test and other methods of control were used to provide residuals as high as 2.0 ppm.—but the results were not entirely satisfactory and better control methods were indicated. Finally, it was appreciated that the maximum efficiency would be obtained only when the residual provided was almost entirely (85 to 100%) free chlorine.

By means of slides, these three periods of operation were illustrated. Until the present standard of control was established, results were erratic; but, with a free chlorine residual maintained, gas-forming organisms are almost nonexistent in the finished water or in the distribution system. Tastes and odors are practically eliminated by the same treatment. It was concluded that a free chlorine residual is essential, but that a small increase in chlorine dose is required to accomplish these results. Residuals range only from 0.45 to 0.8 ppm. when the control point is properly applied. For perfection in operation, continued research is required.

"Practical Use of the Ortho-Tolidine—Arsenite Test for Residual Chlorine," by F. W. Gilcreas, Asst. Dir., Division of Labs. and Research, State Dept. Health, Albany, N. Y., and F. J. Hallinan, Armour Research Foundation, Chicago, Ill.

While the ortho-tolidine test has long been the standard procedure for controlling chlorination, the desirability of more specific indicators has long been recognized—especially to compensate for interfering substances. Research has disclosed that active chlorine is desirable for disinfection of water, but the standard test measures free active chlorine, the less active chlorine combined with ammonia or other nitrogen compounds, and may show a false residual due to interfering substances. Thus, a technic which will differentiate between these several color-producing substances is needed.

The O-T-A test is a simple modification of the standard procedure, utilizing a sodium arsenite solution, which seems to fill this need. Full details have been published

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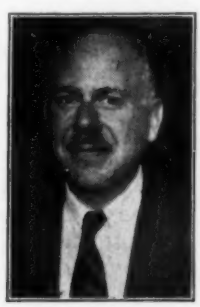
Sanitary Engr. and Chief Chemist
Ind. Water Co.
Indianapolis

Secretary
Chas. R. Cox
Chief
Bureau of Water
N. Y. Dept. of Health
Albany, N. Y.



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Prof. of San. Eng.
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Newark, N. J.

in the AWWA Journal, March 1944, page 296.

To obtain data regarding the usefulness of this test in the hands of water plant operators, its use was studied for one month at 23 water supplies in New York State and complete reports were submitted. Each operator determined four items: free chlorine, chloramine, false residual, and the conventional ortho-tolidine results. Three of the plants repeatedly reported false residual values. Analysis of special samples from these plants showed significant amounts of manganese to be present in the untreated water.

This field test demonstrated the capacity of the O-T-A test to differentiate active chlorine from combined forms of chlorine. In 17 of the reporting plants not adding ammonia as part of the treatment process, 3 found the active chlorine to be less than one-third of the total residual the majority of the time. Only 6 found an active chlorine residual higher than two-thirds of the total residual throughout the test.

In 6 of the reporting supplies, where ammonia was added, two found active chlorine residuals greater than one-third of the total chlorine—indicating the dose of ammonia to be inadequate for complete reaction with chlorine. Of the 659 days represented by these tests on 23 supplies, a false residual was found on 102 days, and on 84 days the chloramine residual was 0.3 ppm. or less with no active chlorine present.

These results indicate the test to have two important advantages: it provides a simple method for the elimination of interference and it enables the operator to determine both active and combined chlorine. Routine use shows the O-T-A test adaptable to proper control of chlorination treatment.

"The Mechanism of Destruction of Microorganisms in Water by Chlorine and Chloramine," by S. L. Chang, Research Fellow in Sanitary Engineering, Harvard University, Cambridge, Mass.

While chlorine and chlorine compounds have been employed during the past half-century for destroying microorganisms, it is still uncertain whether this is accomplished by oxidation, by direct chlorination of the protoplasm, or by degeneration of the cell wall. The extremely small size of the organisms involved has made the problem difficult to solve. Most logical of all suppositions or theories is the modern belief that a toxic substance is formed within the cell.

In the case of amoebic dysentery cysts, Dr. Chang has showed earlier

Handsome Host

L. F. Warrick, Chief
San. Engineering Dir.
State Dept. Health
Madison, Wis.

that chlorine actually penetrates through their cell walls; death is then probably due to structural changes. The present study shows that penetration of the cell is greater as the chlorine dose is increased, that penetration increases with increasing contact time, that above pH 8.5 penetration of chlorine essentially ceases, and that the chloramine type of compounds penetrate more slowly than chlorine or not at all. Dr. Chang also presented data on studies designed to

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evaluate the effect of nascent oxygen and to differentiate between poisoning as compared with cell destruction.

Cell penetration was shown by the development of yellow ortho-tolidine color inside cell walls. The effect of nascent oxygen was studied by using hydrogen peroxide; it was found that 3,000 ppm. of this compound did not kill cysts in 60 min., but 6,000 ppm. did kill in 120 min. Most probable cause of cell death (cysticidal effect) was traced to the formation of new compounds within the cell. Precipitation was shown to occur in chlorine-treated peptone solutions and microscopic observation disclosed changes in cell protein after chlorination. Protoplasm was found to shrink from cell walls, coagulation and other changes occurred, neuclei were damaged, and the cytoplasm became spongy.

In addition to these observable physical changes, there is indirect evidence that chlorine may combine to form organic chloramines with the cell contents. When less resistant bacteria are exposed, the disinfecting action may not depend on free chlorine, but may result from the chloramine type of compounds.

"The Bacteria in the Distribution System," by A. M. Shannon and W. M. Wallace, respectively Senior Sanitary Chemist and Supt. of Filtration, Department of Water Supply, Detroit, Mich.

Mr. Wallace presented a progress report on an extensive investigation of the Detroit distribution to determine types and significance of bacteria present, to evaluate other products or toxic compounds formed, to learn the best method of taste and odor elimination, and to assess the present standards of water quality. Since 1940, samples have been regularly collected for analysis from six dead ends of the

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system and from one artificial dead end in the grounds of the filtration plant.

Ammonia-chlorine treatment of filtered water provides a residual throughout the distribution system except in the dead ends. Temperature appears to be a factor of considerable importance, since higher dead-end counts follow higher temperatures. Another factor is velocity of flow—the lowest counts being in samples from the largest mains. Results appear to be no different when chlorine or chloramine are used.

Many types of bacteria have been isolated; this paper described their identification and pathogenicity. Chromogenic bacteria are present in considerable number. The authors feel that main breaks and new construction account for the majority of pathogens found, since none are recovered from the plant effluent or from the dead end on the plant grounds. Much further study is planned to complete this entire investigation.

"Influence of Various Chemicals on the Palatability of Drinking Water," by J. W. Hassler, Director of Research, Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., Tyrone, Pa., and Martin Faye, Chem. and Eng. Service, Industrial Chemical Sales Div., Cleveland, Ohio.

Considerable data have been collected by the authors, through field studies at water treatment plants, regarding the effect of treatment chemicals on taste and odor removal. They exhibited graphs illustrating the results obtained.

The effect of lime was shown in 12 supplies studied: this chemical increased odor in one case, had no apparent effect in seven cases, and reduced odor in four cases. Lime and activated carbon always reduced the original odor. Chlorine, in a dose sufficient to disinfect and to leave a slight residual, generally increased odors. When chlorine and carbon were used together, additional carbon was generally necessary—as compared with the dose required when using carbon alone—but, in some cases, better absorption of odor resulted from chlorination.

The practical significance of these findings is that some waters demonstrate a better taste and odor removal if carbon is used before chlorination, and others if carbon is used after chlorination. Studies showed that application of breakpoint chlorination doses were limited to a maximum odor removal

"Brass Hats"

Major B. A. Poole, Office Chief of Engrs. Repairs & Utilities Br., Washington (Former Chief Engr. Indiana State Dept. Health)

Capt. R. M. Dixon, U. S. Engineers Dallas, Texas (Former San. Engr., Dept. Water & Sewerage, Dallas)

Lt. Col. Wm. H. Weir, Sanitary Corps Washington (Former Co-Director, Eng. Div., Ga. Dept. of Health)

but that removal of odors with carbon increased with increasing doses of chemical. If carbon is applied before chlorine, adequate settling time should be provided; if chlorine is applied first, adequate contact time should be provided before adding carbon. The development of such data should be of practical value.

"Permissible Loadings and Capacities of Water Treatment Plants," A Committee Report by Douglas Ferben, Senior San. Chemist, City Filtration Plant, Detroit, Mich.

This report, read in the absence of the author by Mr. Chas. R. Cox, described the difficulties experienced in obtaining basic data: only 35 returns have been received from 103 questionnaires sent to treatment plants. The committee is compiling data on high-rate filtration and on short-term water preparation. Contributions from plant operators will be of great assistance.

"Noteworthy"

At least so thinks C. & O. Rys. Water Expert Dick Bardwell of Richmond, Va., who is taking down some information from Major Dick Messer, AWWA Director and Chief Engr. Va. State Dept. of Health. On left, Johnnie O'Neill, Chief Engr., La. State Health Dept., just isn't interested for the moment. The name of the fourth victim of this candid shot has us stumped.

Programmers

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Water and Sewage
Expert
The Dorr Co.
N. Y. City

H. V. Pedersen
Supt. & Genl. Mgr.
Water Dept.
Marshalltown, Ia.

"A Consolidated Coliometer for Streamlined Water Bacteriology," by A. A. Hirsch, Instructor in Water Purification, State Dept. of Education, Baton Rouge, La.

Mr. Hirsch demonstrated and described a unique piece of equipment which he has developed from the basic idea of the Smith fermentation tube. His Coliometer consists of a glass bottle having five internal vertical glass tubes; these are so arranged and connected as to provide calibrated volumes.

The Coliometer is supplied with culture media and distilled water, then is autoclaved. The water sample is collected in the bottle which is subsequently manipulated to automatically introduce proper volumes of water sample and media into the calibrated tubes. Upon incubation, gas formation may be determined in the 100, 50, and 10 ml. portions. A glass loop, filled with brilliant green bile medium, may be placed inside the unit to provide a confirmatory test. From the three volumes examined, the coliform index may be calculated.

Mr. Hirsch called attention to the simplicity of such equipment for small plant laboratories. Its use, he believes, would result in savings in time and in the cost of culture media in large laboratories. The three volumes of sample incu-

bated provide an adequate statistical coverage. While the original cost of equipment is high, the saving in media should more than equalize this cost.

"The Economics of a De-Ionized Water Supply," by Frank Bachmann, Water Specialist, The Dorr Co., Inc., New York, N. Y.

After some ten years of investigation, there are 50 or more commercial materials now available for specific types of water conditioning. Mr. Bachmann defined de-ionization as the process by which ions are removed or exchanged from water solution. This definition does not include zeolites, since the new materials are strictly organic in nature. There are two general types: cation exchangers and anion absorbers. As all reactions are reversible, the regeneration of the ion exchange material becomes possible. Demineralization is not a cheap method of treating water and is not a substitute for municipal purification.

Examples of de-ionization applied on large scale to industrial water supplies were cited. In one plant, water high in sodium carbonate is treated in two cation exchangers, reducing the sodium concentration of 1465 ppm. to 40 ppm. By treating half of the raw water and mixing with the untreated portion, a satisfactory finished water containing 753 ppm. of sodium is produced. This plant produces 0.6 mgd. of water at a total annual operating cost of $36,320.

Another plant utilizes both cation and anion exchange resins for more complete treatment. Daily production of finished water is 0.9 mgd. (52% treated and 48% raw water) at an estimated operating cost of $88,250. Complete de-ionization (except for removal of silica) is possible but generally unnecessary. The process is considerably cheaper than distillation—chemical costs varying directly with the concentration of ions present. A wide application of de-ionizing materials for industrial purposes is contemplated.

"Diatomite Water Filtration Developed for Field Troops," by Hayse H. Black, Capt. Corps of Engineers, U.S.A., Chief, Water Supply Equipment Branch, and Chas. H. Spaulding, Engineer, The Engineer Board, Fort Belvoir, Va.

The need for improved field filtration equipment arose from the failure of sand filters to remove cysts of amoebic dysentery from water at high (6 to 12 gal. per min. per sq. ft.) rates employed in the field. Filtration equipment developed to employ diatomite (diatomaceous earth) as a filter aid, however, removes practically all cysts under the most severe tests.

To support the diatomite cylindrical elements of porous refractory materials or of helically wound wire have been found most satisfactory. A pre-coat cake of diatomite is deposited on the support by circulating a slurry through the unit. The cake deposited will be 0.06 to 0.09 inch thick when the usual dose of 1.0 to 1.5 pounds of filter aid per 10 sq. ft. of support is used. This cake retains suspended matter as the water is filtered through in pressure filter units.

Two sizes of diatomite filtration equipment have been produced for field use. One has 3.6 sq. ft. of filter area, a nominal capacity of 15 gpm., and weighs 50 pounds. The other has 10 sq. ft. of filter area, a capacity of 50 gpm., and weighs 350 pounds. The pump required is a separate item.

"Calcining Sludge from a Water Softening Plant," by H. V. Pedersen, Supt. and Genl. Mgr., Marshalltown Water Works, Marshalltown, Iowa.

When the Marshalltown water softening plant was installed, the author started investigating means for disposal of the lime sludge. A means of dewatering and drying was feasible, but the calcium carbonate accumulated so rapidly that the dry material presented almost as great a disposal problem. Next the calcining step was investigated, as a means of removing carbon dioxide and producing calcium oxide or quicklime.

Mr. Pedersen described experiments with home-made equipment and the experimental development of furnaces. The final equipment includes: a Bird centrifuge, flash drying, and calcining of the dry calcium carbonate powder in an oil-heated furnace. Heat from the furnace is not wasted, but is used to dry the succeeding batch of sludge. The calcium oxide is reused in the softening process.

At first a mixture of the home-made lime and of commercial lime was employed. When this gave satisfactory results, entire treatment with the home-made lime was started. The only difference noted is that a larger dose is required because the plant product is lower in oxide content. Impurities did not increase as contemplated, because the iron and magnesium were largely removed. These impurities remained in the furnace and were separated daily. The quicklime produced is light tan in color and is fluffy in quality, but feeds well from the hopper. Mr. Pedersen deserves commendation for his thorough study and for his accomplishments in this problem.

"Recovery of Calcium Carbonate or Lime from Water Softening Sludges," by Robt. T. Sheen, Assoc. Dir., Consulting Div., W. H. and L. D. Betz, Philadelphia, Pa., and H. B. Lammers, Power Supervisor, Wright Aeronautical Corp., Cincinnati, Ohio.

When the problem of lime sludge disposal arose in connection with the design of a 22 mgd. water softening plant at the new Wright Aeronautical plant, there were no softening plants of appreciable size utilizing such sludge on a commercial scale. Pilot plant tests were run to evaluate methods for the recovery of calcium carbonate in a purified form and to burn sludge for producing calcium oxide. These indicated the practicality of such processes.

An investigation also revealed that a finely divided calcium carbonate could be sold locally for neutralizing soil acid, as a filler in the manufacture of roofing material, plastics, rubber, paint, millboard, etc. The calcium carbonate could be sold at five to eight dollars per ton, provided a satisfactory particle size could be assured. Lime is purchased at the plant for $8.60 per ton.

As the capital investment required for calcium carbonate production is about two-thirds that for lime burning, the former was installed. The recovery equipment includes thickeners, a centrifuge, a pug mill mixer, and a two-stage flash dryer. Raw sludge contains about 5% solids, thickened sludge contains about 20% solids, centrifuged sludge contains about 65 to 70% solids, and the final calcium carbonate contains an average of only 0.25% moisture.

Investigation prior to design revealed that a continuous centrifuge would not only dewater the sludge, but would also deflocculate it—segregating the calcium carbonate from all other impurities including magnesium, iron, aluminum, silica, and organic matter. The process is economical and it is hoped that similar methods for producing calcium carbonate and quicklime can be developed on a smaller scale for small water softening plants.

AWWA IN MILWAUKE

(PART II)

The Second and Concluding Installment of a Report Covering the 64th Annual Conference of A.W.W.A. in Milwaukee, Wis. June 13-16, 1944

IN OUR July issue, Part I of the report covering the Milwaukee conference of the American Water Works Association was presented. Because of its length all of the report could not be printed in the single issue. In this second and concluding installment we present digests of papers read in the session of the Finance and Accounting Division, the joint session of the Plant Management and the F. & A. Divisions, the open sessions of the Committee on Steel Pipe and the Committee on Deep Wells and Deep Well Pumps. Under a separate heading in this same issue is the report covering the proceedings of the Water Purification Division which proved too voluminous for inclusion in our July issue and we preferred delaying the report rather than split it between two issues.

*SYMPOSIUM ON WATER WORKS MANAGEMENT**

In the joint session of the Plant Management and the Finance and Accounting Divisions these papers were presented on the subject of management and administration of water works. Acting as the leader of these discussions, Wendell R. LaDue, Supt. of Water and Sewerage for Akron, Ohio, opened the session with a review of the organization

Programmers

Chas. E. Moore, Mgr. Water Dept. Roanoke, Va.

W. R. La Due, Supt. Water & Sewerage Akron, Ohio

and work of the Committee on Plant Management of which he is chairman. One of the chief duties of this important committee is a study of the several forms of water plant management with the view of comparing the good and the bad of each type of management and developing something in the nature of a guide to good municipal plant management.

Following the management symposium, members heard of the procedure of State Regulation of Publicly Owned Water Utilities in Wisconsin and a paper on Water Works Management in South America.

Division Chairmen

A. P. Kuranz Supt. of Water Waukesha, Wis. **(Finance and Accounting)**

F. C. Amsbary, Mgr. Illinois Water Co. Champaign, Ill. **(Plant Management)**

Practice in Nebraska

Practice in Nebraska was described by D. L. Erickson, Dir. and City Engr., Dept. of Parks, Public Property, and Improvements, Lincoln, Neb.

Mr. Erickson described the management system of Lincoln in some detail and explained the state statutes which set up the system under which water works are managed. Omaha has a metropolitan water district independent of the city government. Other cities have boards of public works.

As to means of financing Mr. Erickson said that revenue bonds were popular and that these were authorized at elections. Combination of the water and electric utilities is also done sometimes.

Unfortunately, John S. Longwell, Ch. Engr. and Gen. Mgr., East Bay Municipal Utility Dist., Oakland, Cal., was delayed by floods also and his paper on management practices in California was with him somewhere west of the Mississippi.

Virginia Practice

The various systems of management in the State of Virginia were discussed by Charles E. Moore, Manager, Water Dept., Roanoke, Va. There are both constitutional and code provisions in this state for cities of from 200 to 5,000 and over. Limitations are imposed on the indebtedness of the cities, and charters may contain provisions for the segregation of water works funds. There may be commission or municipal jurisdiction and a city may choose the system best suited to its purposes.

Mr. Moore suggested a plan for the organization of water works management, making a particular point of the advisability of patterning municipal water utilities after private systems, for it is good business to sell good service. Mr. Moore also favors a commission which will have the right to contruct and operate a water supply in all its phases and he believes that a management should operate a water plant properly at all times.

In closing the symposium, Mr. LaDue, the discussion leader, commented on various phases of water works management. Metropolitan districts as in Boston, Los Angeles, and elsewhere have many advantages; they are superimposed on the city governments, are unaffected by politics, and

Programmers

D. L. Erickson City Engr. and Director of Public Property Lincoln, Neb.

H. B. Gotaas, Chief Engineering Sect. Office of Inter-Am. Affairs Washington*

**Mr. Gotaas holds the rank of Lt. Col. in the Sanitary Corps—U. S. Army.*

*Reported by Dr. George E. Symons, Associate Editor.

responsible only to the public. Commissions or city managers may be good or they may be bad. Manager and council forms of government likewise are sometimes successful and sometimes not. Another system is the one man utility manager and council.

Mr. LaDue said that many water plants would continue to operate under the latter two systems mentioned, and he suggested that a study be undertaken by AWWA to arrive at causes of weakness in these two systems and steps to improve them.

Mr. LaDue bemoaned the transfer of funds from the water department to general use in municipal operation and said that water departments wanted the freedom to collect and spend their own monies. If there is a surplus it should be refunded to the consumer or rates reduced; water utilities do not like to have it transferred, thereby making the water department a party to indirect taxation.

In the establishment of water boards Mr. LaDue sees a trend to revert to the basic principles of private management, and he concluded that water works can do much to improve their status if they make their management earn the confidence of the public.

Utility Regulation in Wisconsin

The concept of water utility regulation in Wisconsin is one of interest to everyone, for there municipal water works are regulated by a state water commission. The ideas and ideals of such regulation were explained by W. F. Whitney, Commissioner, Wisconsin Public Service Commission.

Basic idea of the commission is that competition should regulate prices of commodities except for utilities which are monopolistic and these should be regulated by the state. In the state of Wisconsin this is done.

The Wisconsin commission was originally organized as a railroad commission in 1874 and other utilities were added in 1907, with the name and powers being last changed in 1931 when it became the Public Service Commission.

The purpose of the commission is to see that the public receives service at a reasonable but adequate cost, and without prejudice. The commission can and does furnish advice but not engineering, and it does have a standard accounting system.

According to the accounting system, income goes first to cover expenses. Surplus, if any may go to the city but the city must pay for water service and the water department must pay its share of the school and local taxes. These tax payments are legitimate expenses that must be paid before the surplus becomes available. In addition to expenses the commission allows the utility a reasonable return. Excessive returns are frowned on and in general it is not expected that the utility will have any money to turn over to the city.

Separate accounts are kept for the utility and the city and the utility is operated on a common sense basis. Cash from the accounts receivable, from laying services, from thawing services, and from laying mains goes to the utility. Disbursements go to payrolls, materials purchased, and repairs, maintenance, and power.

According to Mr. Whitney, good water works management is created; it does not just happen. Best management is obtained with a board of commissioners whose terms may be 3, 5, or 7 years. Most of these board members in Wisconsin serve for nothing, others for a small fee. Management of non-partisan boards obtains good superintendents and holds them for a long time. In thirty of the largest cities only six changes have been made in the past 10 years, and of these four were by death, one by ill health, and one by retirement.

In the matter of funds, Mr. Whitney said that the city should pay for water used for fires, public buildings and flushing, and the utility should pay rental, taxes, for garages, and for work of the city engineer, clerk and treasurer.

The key to the success of the Commission in establishing such good water works management in Wisconsin has been the efficient service of the Commission, the proper application of the law, the high caliber of the commissioners, and the cooperation of the local boards and superintendents.

Among the provisions of the Commission is that a delinquent water bill becomes a lien on the property and is spread on the tax rolls. As a result there is a low percentage of uncollected accounts. The problem of over building of mains, so prevalent in some places has been met in Wisconsin by assessing up to half the cost of a six inch main against the property owner. This is equivalent to about one dollar a front foot. Authority from the Commission must be obtained before extensions may be made. These two provisions prevent over-building. If the consumers are dissatisfied with either the service or rates, it requires a petition of only twenty-five names to assure investigation by the Public Service Commission.

The Commission regulations cover among other things, the quality, pollution, pressure, meters, and general service. The Commission urges that water used by municipal buildings also be metered. A summary of thirty cities shows 83 per cent of water delivered is metered, nine per cent used for flushing, etc., and only 8 per cent unaccounted for. There has been a general freedom from complaint against water utilities in Wisconsin or of the water utilities against the Commission largely because the utilities have met the Commission more than half-way.

Water Works Management In South America

Major Robert D. Mitchell, Asst. Chief, Engr. Sect., Div. of Health and Sanitation, Office of Co-ordinator of Inter-American Affairs, read a paper on the "Management and Control of Public Water Supply Services in the Other American Republics" authored by himself and Lt. Col. Harold B. Gotaas, Chief of the same organization.

The paper was prepared in connection with a compilation of engineering reports of the Pan-American Commission. Water supplies in So. America vary widely from springs to purification plants. Slides shown with the paper depicted primitive water supply such as water carts or individual collection of water from streams which are also used for laundering and for bathing. Other cities have large old aqueducts, but some places have such limited supply that the water is cut off at night. Insanitary planning is emphasized in those places where water mains are laid in or through sewers.

Intestinal parasites are quite prevalent in South America, at least 85 per cent of the population being so affected. Sixty-five per cent carry round worms, 44 per cent hook worms, 28 per cent another parasite, and 5.6 per cent Entamoeba histolytica cysts, which means that many of the people carry several different parasites.

It has been observed in South America, just as it was in this country, that the total death rate decreased more rapidly than the typhoid fever death rate as water supplies have been improved. Typhoid fever death rates range from zero to 193 per 100,000 population, but average mostly in the range from 10 to 20. Death rate for typhoid fever in the United States is now only 0.8 per 100,000.

Financing of water supplies in South America is generally a federal government function, with thirteen

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(*AWWA Directors)

countries in Central and South America furnishing federal funds, three by local funding, and four by combined local and federal. Mexico has three methods of financing, depending on the local finances and other factors. There are now but few private plants in South America, since policy has been not to renew franchises of water companies giving generally poor service in past years.

Surface water supplies predominate and it is found that pumps and piping are usually of European make while filtration and chlorination equipment are of American make. Few cities have meters; the cost of water varies widely from 17 cents per month (for 3,750 gallons) in Peru to $8.50 per month for the same amount in Bogota, Colombia, which boasts a modern well operated plant.

There is little softening, not much bacterial control but some tendency toward government control of quality. One country is now holding short schools for operators. In general it may be said that the sanitary era in South America is just beginning.

*PAPERS BEFORE THE FINANCE AND ACCOUNTING DIVISION**

In the closing session on Friday, June 16, the following papers were presented before the Finance and Accounting Division:

"Modernizing Meter Rates," by C. H. Capen, Chief Engr., North Jersey Water Supply Comm., Wanaque, N. J.—Most water works superintendents would welcome a chance to revise meter rate schedules. Electric, gas and telephone rates are usually constant throughout a given area, but not water. Milwaukee sought to charge a higher rate to an outside municipality, but the ensuing 10-year unsatisfactory court case placed limitation thereon.

The 1923 committee report on meter schedules advocated a standard form of rate schedule with domestic service being from 2 to 3 times the industrial rate. Twenty years later it is found that the ratio is 1.76 to 1 for the 30 largest cities in the U. S. Wholesale costs are often more than 50% of total costs. Ways must be found to reduce debt service on sources of supply so as to permit a higher ratio. Akron, Ohio, and Elizabeth, N. J., rates reflect rising and falling schedules respectively. The Passaic Valley Water Commission (N. J.) has ten slides—very unusual.

A chart of rates shows the relation of domestic meter rate (in cents per thousand gallons) $= \frac{60}{P^{0.2}}$ where P is population in thousands. This chart may be used to advantage for comparison and has proven useful in rate adjustments in New Jersey.

Conclusions: Industrial rates should be figured on cost of production plus transportation to city line —usually ¼ to ⅓ of domestic rates. All water services should be charged for and domestic rates should carry a full share of proper costs.

"Balancing Production and Sales Record," by A. P. Kuranz, Supt. of Water, Waukesha, Wis.—In this excellent paper on unaccounted-for water, Mr. Kuranz pointed out that if losses of 8⅓% could be recovered, the equivalent of one month's pumping and purification would be saved. In the 20's, 75% accounted for was considered good. In 11 years, 81 articles have been read on this subject. No system can be perfect.

Three groups of losses are (1) leaks in distribution system; (2) leaks in service pipes; (3) underregistration of meters. Former figures for allowable main leakage (250-gal./inch/mile per day) was too high. Main leakage is generally less than two per cent. Service pipe losses are mostly at goose-necks. Meter underregistration is being improved. Many meters are too large and not enough attention is paid to this feature. Checking meters is important.

In Wisconsin in the 35 cities containing most of the population, an average of 80.8% of water pumped is sold, the range varying from 24% to 94%. Improvement on meters has helped. Underregistration is about 4% for well maintained meters.

Summing up losses should not exceed 2% for distribution, 3% for services and 4% for meter underregistration, thus 91% of water would be accounted for. Many cities have improved from 80 to 85% and are now aiming at 90%. If free water were measured, waste would be less. Water men should take a more prominent part in civic affairs.

Commenting on this paper, W. W. Brush said that leakage surveys should continue until cost of survey is greater than value of water saved. London, England, has gone furthest with this work. New York City has 12 crews operating, but is not trying to do a complete job.

SYMPOSIUM ON JOINT WATER AND SEWER ADMINISTRATION

(L. N. Thompson, Presiding)

Thos L. Amiss, Shreveport, La.—In 1942, "WATER WORKS AND SEWERAGE" carried a strong editorial ad-

Two Directors—Three Aces

H. S. Thane*	Dale Maffitt	Thos. J. Skinker	M. H. Schwartz*	Alan T. Drake
Supt.	Genl. Mgr.	Supt.	Supt.	Dir. of Water
Missoula, Mont.	Des Moines, Ia.	Dir. Utilities St. Louis, Mo.	Vincennes, Ind.	Buffalo, N. Y.

(*AWWA Directors)

*Reported by Chas. H. Capen, Chief Engineer, North Jersey Water Supply Commission.

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("Lindy")

John R. Purser
President
Purser Eng. Co.
Charlotte, N. C.
(Chm. N. C. Sect.)

E. B. Rausch
Pres. & G. M.
Am. Well Wks.
Aurora, Ill.
("E. B.")

vocating joint operation of the two utilities. Pre-war days had no problems of labor and materials, but both are now scarce. (The Shreveport Department has lost 6 men in the engineering force to the service). Post-war adjustment will be even more difficult and must be considered from the social and economic standpoint, rather than the political. Summing up—joint operation of water and sewer systems has helped in this case and war-time conditions have aided consolidation. A 5th freedom is needed—"Freedom from Politics."

Wendell R. LaDue, Akron, Ohio.—Akron's water system was purchased in 1911 for $920,000. Capital is now $18,000,000. Director of Public Service fixes rates. Definition of surplus still obscure. In 1937 debt service took 75% of revenue; operating costs were $400,000. Today it is $450,000—largely labor cost increases. Sewage treatment was laid out in 1910 when population was 69,000 to serve 120,000 persons—cost $450,000. Population in 1920 was 208,000 and the stream was polluted. Two negative votes were given on bonds for this work. A new sewage treatment plant was constructed in 1927-1928 at a cost of $3,644,000 and costs were put in tax levy as plant was never publicly approved. Lagooning of sludge was necessary and rubber plants cooperated. Plant designed for 40 mgd. with 185 p.p.m. suspended solids or 25.4 tons of sludge per day. Flow in 1943 was 52.2 mgd. with 370 p.p.m. or 80.4 tons of sludge per day. The receiving stream at Akron is often smaller than the sewage flow and damage suits resulted.

Akron did not take advantage of the Ohio Sewer Rental Law. The water works has always been a profitable going concern and has been prominent before the public. A 1943 Ohio act permits use of surplus funds for sewage treatment up to 10% of gross revenue, provided both utilities are under one supervision. If surplus is over 15%, rates may be reduced.

Summarizing two years of experience in Akron under joint operation the following benefits are noted: Joint use of office, garage and shops, tools, storeroom, staff, and engineering divisions, centralized contact with city officials, more uniformity, better public relations and better finances. The trend is definitely and properly in the direction of joint management and operation of water and sewerage facilities.

James W. Myers, Kenosha, Wis.—Water departments in Wisconsin are under the Public Service Commission and fear large surpluses. Accurate accounts are kept. The Kenosha system started in 1894 and was added to in 1916, taking water from Lake Michigan. Capital investment is $2,300,000. The sewage plant provides separate sludge treatment for 10 mgd. and was built in 1940 at a cost of over $500,000. Under a sewer rental enactment, a fee is charged each user, commensurate with water use. Combined bills are issued.

This is a unique case where the sewage plant was built by the water department as an adjunct to protect the water supply. The speaker originally opposed the idea but now sees the benefit.

John W. Pray, Ft. Dodge, Ia.—Since both water and sewer systems are most often publicly owned, the public naturally looks to the well organized water system to handle the sewer system. In Fort Dodge this has always been true and all sewage treatment plant details cleared through the water office. Billings are included on water bills and joint accounting is under one man. There is a sub-division head for the office, meter shop, sewage treatment plant, water plant, hydro-electric plant, water and sewer systems, garbage collection and disposal system. Interchange of men and equipment is achieved while duplication of effort is eliminated. This is especially beneficial with man-power shortage. Exchange of materials is a distinct benefit also.

Expressions of opinion on joint management were as follows:

(a) From a number of water

Wm. B. Clark
Supt. Pub. Wks.
St. Charles, Ill.

•

Carl Duy
Supt. of Water
Aurora, Ill.

•

Carl Hellstrom
Supt. Water & Light
Geneva, Ill.

E. C. Goehring
Ass't Mgr.
Water Authority
Beaver Falls, Pa.

•

Jasper W. Everett, Mgr.
City Water Co.
Springfield, Mo.

•

Lynn O. Minor, Mgr.
Kankakee Water Co.
Kankakee, Ill.

Major L. H. Scott
U. S. Engineers
Atlanta, Ga.

•

"Col." Bart Marshall
Director of Publicity
Chain Belt Co.

•

Capt. Armon Lund
U. S. Engineers
Fort Brag, N. C.

Frank Bachmann
Fred G. Nelson
R. S. Rankin
The Dorr Co.
New York

H. W. Niemeyer
Supt. Distribution
Indianapolis Water Co.

•

L. R. Mathews
Supt. Filtration
Fort Wayne, Ind.

•

P. G. Fulkerson
Chief Chemist
Fort Wayne, Ind.

D. W. Townsend Consoer, Townsend & Assoc. Chicago, Ill.

W. G. Middleton Supt. Public Service Comm. Yazoo City, Miss.

Marvin Cole Supt. of Water Perry, Iowa

Lee Chamberlain Am. Well Works New York

Jas. H. Kennon Mgr., Water Dept. Pittsburgh, Pa.

Max Suter, Engr. State Water Survey Urbana, Ill.

G. Gale Dixon P. B. H. & McD. Engrs. New York

works managers in cities under 60,000 — definite benefits, economical. Politics should be kept out.

(b) In large cities—no opinion expressed but speaker believes it has been successful.

(c) Consulting engineers — in favor, pointing our success of joint water and light plants.

(d) One Iowa superintendent in city of 12,000 with joint management says it should be confined to cities under 25,000.

(e) City of 8,000 with water, light, gas and sewage under one head-superintendent well satisfied and money is saved.

(f) Supt. of Water in a large city in Iowa sees value in joint management for moderate city but not large one.

(g) Water Manager in medium city believes joint management beneficial.

(h) Iowa city of 15,000 finds it very desirable.

(i) Midwest city of 80,000 believes joint operation beneficial as well as other combinations of municipally owned utilities.

In conclusion, local conditions would effect the result but, given proper support, good utility man can make success of any combination of utilities.

*STEEL PIPE COMMITTEES SESSION**

Several papers and a motion picture were presented at the open session of the Steel Pipe Committee on Thursday afternoon. Presiding was Chairman Wm. W. Hurlbut, Chief Engineer of Water Works, Los Angeles, Calif.

Mr. Hurlbut presented a "Report of Current Activities of the Steel Water Pipe Committee," calling attention to the increased use of this material. The Water Works Practice Committee (7A) has published specifications and standards in the Journal of the A.W.W.A., October, 1943, issue. Mr. Hurlbut requested that water works users of steel pipe report their experiences with it, as these contributions can be extremely helpful. Further work of the committee is in progress.

"The Camp Robinson Water Supply Line," by W. L. Patterson, Black and Veatch, Engrs., Kansas City, Mo.—Camp Robinson is located six miles north of Little Rock, Arkansas, and the logical source of water was the treated mountain supply of Little Rock. A 16-inch steel line was laid, protected by coal tar primer and hot enamel on the interior; with primer, hot enamel, and bonded asbestos on the exterior. Low point of the line is at the river crossing, between the city and the camp, where static pressure is 190 pounds.

Location of the river crossing was carefully selected in order to maintain a minimum length of line and also to require no joint deflections in excess of 15 degrees maximum. Ball and socket cast iron pipe was used for the crossing—a difficult point because a portion of the sand bottom of the river goes into suspension during flood waters. To protect the 2.5 mg. storage at the camp, a cone type check valve was installed in the line to prevent backflow. Additional pumping capacity of 3 mgd. was installed at the Little Rock plant and, if camp requirements increase in the future, the installation of booster pumps is planned.

Construction of the 28,000-foot line was started September 28, 1940, and was completed less than three months later—on December 19. This record was made despite the fact that random lengths of pipe were unexpectedly delivered and the valves and fittings were not received until December. The 83 days required for construction included only 28 actual working days due to rain, lack of material, etc. Pipe was laid in the river bed with a 3-foot cover; this was accomplished through the use of jetting equipment on barges to agitate the river bed to that depth. After the entire line had been in operation for one month only one joint was found to

*Reported by Harry A. Faber, Editorial Associate.

Jas. M. Angell, Jr. "Water Wks. & Sewerage" New York and H. Vance Crawford Gen'l Elec. Co. Schenectady, N. Y.

John Crampton Supt. Light & Water Bay City, Mich.

•

L. L. Lang Comm. of Water Harbor Beach, Mich.

•

R. E. Ritchie Supt. of Water Harbor Beach, Mich.

Capt. J. B. Baty Sanitary Corps Washington and Capt. A. P. Troemper Sanitary Corps 7th Service Comm. Omaha, Neb.

L. E. Rein, Pres. P.F.T., Chicago

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R. P. Farrell, Director Eng. Dir., Tenn. Dept. of H.

•

Bart Marshall Chain Belt Co.

•

G. Gale Dixon Consulting Engr. New York

Marsden Smith Chief Engr. Dept. of Utilities Richmond, Va. and Dale S. Maffitt Gen'l Manager Water Dept. Des Moines, Ia.

be leaking. After three years of service, a C value of 130 was determined by U. S. army engineers.

In discussion, Mr. Patterson explained that a 5/16 inch wall thickness would probably have been satisfactory, but that 3/8 inch was used as conservative design. Maximum working pressure on this line is 120 lb. per sq. in. at the Little Rock plant and 215 lb. at the river crossing.

"Behavior of Steel Pipe Under Embankments and in Trenches," by R. E. Barnard, Advisory Engineer, American Rolling Mill Co., Middletown, Ohio. — Mr. Barnard presented a lucid discussion of a highly technical subject. He pointed out that engineers work with formulas as workmen use tools. The engineer need not make his formulas any more than a workman makes his tools, but the proper formula must be used in the proper place.

Pipe may be classified as two types: Rigid, such as concrete or cast iron; flexible, such as steel pipe of any wall thickness. Corrugated culverts under highways are not very thick but may carry loads as high as one million pounds per square inch. Flexible pipe obviously behaves under some theory other than that which is the basis of the formula ordinarily used.

Thus, the author pointed out that the formula for rigid wall pipe is not applicable to flexible pipe, but that another formula must be employed. In the manufacture of steel pipe from plate, the required temperature passes the yield point of the material. At this point the characteristic grain structure of the steel is reoriented, and the resultant changes produce a flexible pipe.

Slides were presented to illustrate these points. Photographs of 5-foot and 6-foot culverts of corrugated pipe, in actual installations, showed these light pipes capable of supporting over one million pounds. Studies of load, pressure, and deflection conditions disclosed that the pressures generated at the sides of the pipe help to carry the load. Thus, the safety factor is determined by both the strength of the pipe wall and by an earth assistance factor.

The method of determining these factors and a specific formula for calculations with flexible pipe will be provided in the published paper. Mr. Barnard explained that steel pipe can deflect up to 20 per cent of its diameter before failure.

"Charting the Future for Postwar," by Bennett Chapple, Asst. to the President, American Rolling Mill Co., Middletown, Ohio.—In a stimulating review of the manner in which war production needs were and are being met, Mr. Chapple drew a vivid picture of the vision of private industry. The postwar problem he defined as one of employment (not through regimented government), of utilizing to the greatest advantage all new scientific developments, and of recognition of responsibilities under democracy.

Programmers

John W. Pray
Mgr. of Utilities
Ft. Dodge, Ia.

Jas. W. Myers, Jr.
Supt. Water & Sewerage
Kenosha, Wis.

Wm. W. Hurlbut
Chief Engr. of Water
Los Angeles, Calif.
(Chmn. Steel Pipe Comm.)

"Dixie Pipe Line—A Color Sound Motion Picture."—This thirty-minute film utilized an example of a war production plant in need of water and showed the use of a steel pipe to move water from where it was to where it is wanted. Excellent photography portrayed the methods of coating pipe interior and exterior with hot enamel in the field. Methods of trenching, blasting rock, laying sections, and backfilling were treated in detail. The movie will be of value to technical individuals and to laymen alike.

*SESSION ON GROUND WATER SUPPLIES**

(Co-Chairmen J. A. Carr and J. C. Harding, Presiding)

Despite the sweltering atmosphere and the fact that it was the last morning of the conference, some 200 attended the open session of the Committee on Ground Water Supplies, planned to develop discussion of the proposed A.W.W.A. specifications for deep wells and deep well pumps, and the new Sanitation Manual of the U. S. Public Health Service for Public Ground Water Supplies.

The meeting was opened by Co-Chairman James C. Harding, Com. Pub. Wks., Westchester County, N. Y., who advised as to the present status of the deep well specifications. Stating that the committee had been working on their preparation since 1940, Mr. Harding said they hoped to have a final draft ready for the January meeting of the Water Works Practice Committee. Difficulty was experienced due to the wide field that had to be covered and the many types of well construction prevalent in various parts of the country. It is anticipated that the specifications will contain sufficient information so that the engineer or water superintendent with some experience in well construction may draw a good specification for the ordinary job although on work of unusual nature or difficult construction expert advice will be required. Criticisms were requested in order that the next draft of the specifications may represent an improvement over the present draft.

Lewis S. Finch, Ch. Engr., Indianapolis (Ind.) Water Co., stressed the importance of considering drawdown in making tests to determine the yield of wells, and suggested that the committee should have included drillers as well as engineers and superintendents. The chairman replied that although no drillers were on the committee a number of them had been consulted frequently on practically every phase of the specifications.

O. E. Brownell, Asst. Engr., Minnesota Health Department, advocated stressing the desirability of taking care in selecting a proper site for a well as this factor has a large bearing as to whether the well will produce safe water and suggested that the specifications should contain a form of well log.

E. N. Greme, St. Paul, Minn., stressed the necessity of limiting drawdown and cited instances where trouble had been experienced because wells had been overpumped. The water level should be not less than eight feet above the pump.

A. W. Ross, Montclair, N. J., commented on the fact that siliconbronze, commonly known as "Everdur" metal, was now widely accepted

*Reported by James C. Harding, Commissioner of Public Works, Westchester County, New York.

for well screens. Mr. Ross believed the specifications should call attention to the possibility of using other materials but should give more emphasis to the advantages of this material.

The question of how long a delay should ensue between the completion of grouting and the recommending of drilling was debated by Leon A. Smith, Madison, Wis.; Frank C. Amsbury, Champaign, Ill.; Paul Schweitzer, Norfolk, Va., and C. F. Wertz, Miami, Fla. The proposed specifications require a wait of four days. It was stated by some that this would hold up well drilling operations too long and consequently increase the cost of the well, and by others that inasmuch as the entire investment in the well might be jeopardized by not waiting, the recommended period should not be shortened.

E. W. Bennison, St. Paul, Minn., did not believe that the length of screen and the size of openings should be fixed by the specifications, since information from test samples (to be secured during drilling operations) should be available before the screen is selected. This thought was agreed with by **E. J. Rogers** of Milwaukee, except that he believed it possible to specify a screen if a test well had been drilled first. **M. E. Rogers,** Wichita, Kan., thought that definite screen sizes should be omitted from the specifications and the responsibility placed on the well drilling contractor to supply the desired quantity of water at a predetermined maximum velocity through the slots.

The relative merits of wrought iron and steel for casings were discussed, it being the opinion of some that wrought iron was preferable. Galvanizing of well casings, however, was definitely frowned on.

Specifications for Turbine Pumps

Co-Chairman J. Arthur Carr,

Co-Chairmen
Committee on Deep Wells

J. Arthur Carr
Supt.
Water Dept.
Ridgewood, N. J.

Jas. C. Harding
Comm. Public Wks.
Westchester Co.
White Plains, N. Y.

Supt. of Water, Ridgewood, N. J., then introduced the subject of the proposed specifications for deep well turbine pumps. Mr. Carr pointed out that considerable misunderstanding had arisen because many pump manufacturers had confused the A.W.W.A. specifications with the U. S. Public Health Service Sanitation Manual for Public Ground Water Supplies. This manual recommends the elimination of oil lubrication for turbine pumps whereas the A.W.W.A. specification permits it. Chairman Carr further stressed the fact that the proposed A.W.W.A. specifications will not attempt to dictate the design or methods of manufacture of pumps but merely advocate a method under which they may be purchased.

"Big Three" at Work

President Sam Morris presiding at a directors' meeting with Secy. Harry Jordan on his right and incoming President Sam Newkirk on his left.

Mr. Gordon recommended that the specifications include a requirement that pump bowls should always be submerged and also that the factory test be the controlling test rather than the field test.

Leon Smith, Supt. of Water, Madison, Wis., took issue with the other speakers who believed that the specifications of the Hydraulic Institute were for the good of all concerned, including the consumer, and therefore should be followed. It was his feeling that their specifications were largely for the benefit of the manufacturer and should not be subscribed to entirely by the A.W.W.A.

O. J. Muegge, State Dept. of Health, Madison, Wis., discussed the new Sanitation Manual for Public Ground Water Supplies of the U. S. Public Health Service at considerable length, stating that whereas much of the manual was very good, considerable fault could be found with many of its sections. Amongst other things, the specification that water pipes be laid down above the elevation of nearby sewers and at least 10 feet laterally therefrom, were considered impracticable.

Charles R. Cox, State Dept. of Health, Albany, N. Y., stated that the manual, if adopted by state health departments, would have all the effect of a law whereas it should only represent an outline of good practice. Mr. Cox pointed out that there is a direct conflict between the requirements of the manual and the new Official Drinking Water Standards of the U. S. Public Health Service. The degree of water treatment required by the manual was based on surface water requirements and is needlessly severe for underground supplies.

Francis Friel Honored

At the June meeting of the Philadelphia Chapter of the American Society of Civil Engineers, Francis S. Friel was elected President.

Mr. Friel directs the engineering staff of Albright and Friel, Inc., Consulting Engineers, Philadelphia, specializing in water supply, sewerage, industrial waste disposal, and general municipal engineering.

Since the start of the war, this

F. S. Friel

firm has designed and supervised construction of twelve projects for the Army and Navy, with a construction cost of over $50,000,000. A few months ago the firm established a new laboratory for chemical and bacterial analyses in connection with its engineering offices.

Mr. Friel also is serving in the Board of Control of the Federation of Sewage Works Associations, as the Director representing the Pennsylvania Sewage Works Association.

The Legal Limits of a Water Supply System*

By JOHN H. MURDOCH, JR.
Principal Attorney
AMERICAN WATER WORKS & ELEC. CO.
NEW YORK, N. Y.

This paper constitutes a clean cut discussion of a highly important problem with which the public water supply authorities of the country are faced.

So pertinent and timely is this analysis of currently important legal limits of public water supply systems, with discussion and recommendations by such an outstanding water utility attorney and counsellor as John Murdoch, "Water Works and Sewerage" has obtained permission from the AWWA to print it simultaneously with its appearance in the AWWA Journal.

This paper was presented by Mr. Murdoch before the Annual Conference of AWWA in Milwaukee, Wis., June 15, 1944. A digest of it appeared in the report covering the Milwaukee Conference in our July issue, and following it are the highlights of a discussion of the same topic which was presented by Boyd A. Bennett, president, Water Utilities Service Corporation, New York. —Ed.

The Author

(*President, Penna. Water Wks. Assn.*)

THE 1942 Public Health Service Drinking Water Standards contain a definition reading as follows:

"*Water supply system* includes the works and auxiliaries for collection, treatment and distribution from the source of supply to the free-flowing outlet of the ultimate consumer." According to that definition the "limit" of a water supply system is, at one end the source of supply and, at the other end the free-flowing outlet on the premises of the ultimate consumer.

This definition may appear unimportant and to some water works officials may appear to represent a desirable recognition of the fact that bad interior plumbing may result in contamination of a safe potable water supply. It is certainly desirable that cross-connections with unsafe supplies within the property of consumers and submerged inlets in plumbing fixtures be eliminated. Water works officials must be alert to these problems and should interest themselves in taking steps and devising methods to protect the general system from contamination caused by bad conditions on the property of consumers. But there are limits to our abilities and responsibilities.

The importance of the definition and the reason it is not desirable lie in the fact that once it is accepted in practice that the public water supply system extends to the free-flowing outlet on the premises of ultimate consumers, the general public and consumers and courts and juries will presume that the officials of the water works have assumed responsibility for detection and elimination of all potential health hazards on the premises of all consumers in the entire territory served.

In good conscience the water works cannot lull the community into a sense of security by giving the impression that the water works system is free of sanitary defects to the last outlet on each individual consumer's property. No water works should assume responsibility beyond its power to meet the obligations of that responsibility. The quoted definition is an attempt to have the water works assume responsibility for detailed policing of interior plumbing on consumers' premises and therein lies its importance. The impossibility of adequately meeting the new obligation is the reason the definition is not desirable.

Legal Limit as Established by Common Law

Except as restricted by the police power, the owners of real property in America have the absolute right to hold, control and use that property and no other person has the right to enter on or interfere with it.

Where a stranger has no *right* to enter or interfere, the stranger has no *obligation* to enter. Where property and facilities are under the exclusive control of one person, another person has no right and no obligation to assume jurisdiction over that property or those facilities. Each person looks after and manages his own property, being careful to observe the limits of his property rights. Those are fundamental principles of American law and, in recognition of them, it has been customary to draw the line marking the legal limit of the water supply system at the property line or, for convenience, at the curb line. The allocation of rights and responsibilities is made by reference to that line.

Thus the water supply agency usually installs the service line from the street main to the property line and is responsible for the adequacy and the maintenance of that line. On the other hand, the consumer or the property owner installs and maintains the water lines from the property line into and throughout the premises. The property owner has control over his own property and need not permit a stranger to enter and lay or maintain lines.

When service lines freeze between the main and the property line, the water supply agency is usually responsible for thawing, but when the freeze occurs on the consumer's side of the property line, the consumer attends to the thawing.

On complaint of inadequate water service on a consumer's premises, the first fact to be developed before a regulatory commission hearing the complaint is whether adequate or reasonable pressure and quantities are available *at the property line* end of the water supply agency's service line. If they are, then the inadequate service is caused by conditions on the property of the consumer and the consumer will have the responsibility, at his own expense, of bettering the conditions.

The basic right of property which gives the owner the control and exclusive use and occupancy of his property is so well understood and so universally recognized and respected that cases directly referring to it are rare. However, the results which flow from that basic right of property so recognized are constantly considered by legislatures and courts and the water works supply customs here mentioned all develop from this basic property right. Property rights have fixed the legal

limit of the public water supply system at the property line.

Modification of Customary Legal Limit by Contract

There are many water supply systems which by contract acquire rights within the property lines of consumers, and such contracts may be said to modify the legal limit. In systems in which water service charges are based on the number and types of attached facilities, the consumer, in taking service, is assumed to have agreed that representatives of the water supply agency may enter at reasonable times to make inspections of the attached facilities or to check for unnecessary wastage of water. Where meters are installed on consumers' premises the consumers are held to have contracted to give the right to set and maintain and read the meter. In these and similar cases the legal limit has not really been changed, but rather modified by the giving to the water supply agency a limited right in territory which would, except for the contract, be "out of bounds." The true legal limit is still the property line within which the owner is in control.

It has been said that representatives of a water supply agency have the right to enter the consumers' premises to detect leaks. These supposed rights appear usually as instances of rights of entry granted by contract as just mentioned, as in instances where the consumer has asked for help, frequently in connection with an unusually large meter reading. The latter cases are not even modifications of the legal limits.

Modification of Legal Limits by Exercise of Police Power

Before mentioning ways in which the legal limits of a water supply system may be modified through the exercise of the police power, it is necessary to consider the nature of that power and restrictions on its use.

In McQuillin's *Municipal Corporations* it is said that,

"the police power authorizes the enactment and enforcement of laws and regulations requiring each citizen so to conduct himself and so use his own property as not unnecessarily to injure another. The police power is defined by Blackstone to be the power which concerns 'the due regulation and domestic order of the kingdom, whereby the individuals of the state, like members of a well-governed family, are bound to conform their general behavior to the rules of propriety, good neighborhood and good manners, to be decent, industrious and inoffensive in their respective stations.'"

The police power is a much greater, broader power than the power and authority of the organized police force. That organized police force is merely one agency by which the sovereign state attempts to enforce laws enacted under the police power.

The following quotations are also taken from McQuillin, *Municipal Corporations*:

"The exercise of this power necessarily interferes in some respects with the liberty of the citizen, as his right to move about as he pleases, or his right to follow in his own way any lawful occupation, or his right in the use of his property. This interference is justified solely on the ground that it is required in order to protect the personal and property rights of others, and advance the best interests of society. . . . All businesses and occupations and all movements and activities of the citizen in public relations, it is important to remember, are carried on subject to the reasonable exercise of this power. Obviously individual freedom must yield to the enforcement of just regulations for the public good. Appropriate and reasonable legislation or regulation by nation, state or city, therefore, is sanctioned which has for its object the promotion of the public safety, health, convenience and general welfare, or the prevention of fraud and immorality.

"'It may be said in a general way,' remarked Mr. Justice Holmes, 'that the police power extends to all great public needs. It may be put forth in aid of what is sanctioned by usage or held by the prevailing morality or strong preponderant opinion to be greatly and immediately necessary to the public welfare' (219 US, 104).

"Organized government has the inherent right to protect health, life and limb, individual liberty of action, private property and legitimate use thereof, and provide generally for the safety and welfare of its people. . . . Safeguarding the public welfare then in its most comprehensive sense is the basis which justifies the exertion of the police power and the imposition of restrictions on individual action and the use of property."

It should be observed that the police power is not unlimited. Attention is directed to certain points in the quotations.

The exercise of the police power is justified only when it is *required* in order to protect others and advance the best interests of society. The exercise of the power must be *reasonable*. The regulations must be *just, appropriate* and *reasonable* and must be *greatly* and *immediately necessary* to *public welfare*. Unless a regulation under the police power meets these standards the regulation is invalid and unenforceable.

One final quotation from McQuillin:

"Of the exercise of this power to govern as applied to restrictions on the use of private property, it may be remarked that restrictions are justified only when necessary to preserve or promote the public health, morals, safety, comfort, convenience or general welfare of the community. When the use of property does not infringe the rights of others, or limiting its use is not essential to the legitimate exercise of the police power, or when required, where the restrictions imposed pass beyond that which is reasonably necessary to safeguard public welfare, limitations of the use of the property on the part of the owner are not a lawful exercise of the power of sovereignty, but merely an abuse of power resulting in oppression, and are forbidden by the organic laws of the nation and state."

It has long been recognized that the health of a community would be endangered if a consumer were permitted, on his own premises, to cross-connect a polluted water supply with the public water supply. Obviously, open cross-connections between the two supplies could probably result in the drawing of polluted water into the public system. Police power regulations are, therefore, in force almost everywhere forbidding such cross-connections and giving representatives of water supply agencies the right to inspect points of possible cross-connections and the right to discontinue the public supply when improper cross-connections are found. These regulations impose on the property of the consumer a right of inspection by health officers, and often by water supply agency representatives and thus result in a modification of the legal limit. The regulation is a valid exercise of the police power because it is necessary to the public health that cross-connections on consumer premises be forbidden and because the rights given health officials and water supply representatives are rights which are appropriate to safeguard the public.

Such regulations do not make the interior piping on each consumer's premises a part of the public water supply system, but merely limit the rights of the property owner in the use which he may make of his own property. The inspecting officials are charged by law with a duty to make inspections only where they know a secondary supply is available which might easily be cross-connected. There is an absolute prohibition against improper cross-connections and a right, as against the property owner, to make reasonably necessary inspections and to discontinue service if improper cross-connections are found, but the responsibility to make inspections is a limited responsibility. The legal limit of the public water supply system has not been changed from the property line by such regulations.

For many years health department regulations and water works literature maintained a clear distinction between cross-connections and interconnections. The first was a connection between an approved primary public supply and a secondary source of supply not of approved quality. Inter-connections covered all interior plumbing arrangements not involving a secondary source of supply which might result in admitting contamination to the potable supply. Traditionally, the distinction was insisted on in recognition of the facts that true cross-examinations were few in number and were usually well known as to location and presented a very real and ever-present health hazard, while on the other hand, inter-connections were legion in number, their locations unknown and they could result in contamination of the general system of potable supply outside the premises

directly involved only as a result of rare and unusual combinations of circumstances. Unfortunately, this important distinction between cross-connections and inter-connections is specifically and in definite terms done away with in the new Drinking Water Standards, as well as in the model codes being advocated by some state health departments.

As to inter-connections as formerly defined, police power regulations limit property rights. Plumbing ordinances provide a prohibition against installation of unapproved types of plumbing, but it has not been usual to require the elimination of such plumbing if installed before the date of the regulation unless contamination is discovered. Plumbing inspectors and health department officials are usually given a right of entry on private property to examine conditions in the plumbing system and such regulations and inspection rights constitute limitations on property rights. These are valid exercises of the police power because it is reasonably necessary to lessen the chances of contamination of the potable water supply within the premises and because the inter-connections might in rare instances contaminate the general supply.

No responsibility has been placed on water supply agencies to police consumers' premises in a search for possible inter-connections by such regulations. Even trained plumbing inspectors are compelled to content themselves with inspections made pursuant to applications for permits to change or install plumbing or to premises where suspicion has been aroused by bad health records. A police regulation which would attempt to subject all premises to regular inspection and which would require the elimination and destruction of all installations, no matter when installed, which failed to measure up to modern standards, would probably be held to be invalid as not reasonably necessary or appropriate.

The police power regulations dealing with cross-connections and inter-connections seem to impose valid limitations on the rights of property owners or consumers, but only impose duties on the public water supply agencies when they know or should know of conditions on consumers' premises constituting hazards to the general supply in the system. Such regulations do not change the legal limit of the water supply system. Even under the most strict of those regulations the legal limit of a water supply system is still at the property line.

It would be an invalid attempt to exercise the police power should regulations be adopted which would require a water supply agency to police the interior plumbing on the premises of all its consumers. Such a regulation would be invalid because it would be unreasonable as requiring an impossibility, and, secondly, because the remedy provided by the regulation would be unnecessary and inappropriate in attempting to impose on water works operators duties and responsibilities already properly imposed, in the essential features, on the health authorities of the municipality or the state with adequate power and technical ability to perform such duties.

Customary Definition vs. USPHS Definition

Traditionally, the legal limit of a water supply system has been the property line with the rights of the property owner on his own property limited by contract or valid police regulation. The definition of a water supply system based on that legal concept would be:

"A water supply system includes all the works and auxiliaries for collection, treatment and distribution of water from the source of supply to the property line of the ultimate consumer."

The 1942 Drinking Water Standards by definition add to the system all the facilities, plumbing fixtures, spray heads and even garden hose lines and nozzles on consumers' private property, if directly or indirectly connected to the public supply lines. Any item in this added territory not measuring up to modern standards would be considered a "sanitary defect" in the water supply system, and, unless ignored by the state department of health, would prevent water from the system being certified by the Surgeon General of the United States as satisfactory for drinking water on interstate carriers. The result of such failure of certification would be considered as a reflection on the local water supply agency, although that agency could have no effective control over most of the "system" as so defined.

Possible Legal Effects of Acquiescence in New Definition

A water works operator has the legal responsibility to install, maintain and operate reasonably adequate and safe facilities. A water works operator who fails to provide the facilities or service practices, which the consensus of opinion of such groups as the American Water Works Association generally hold to be needed to assure reasonably safe service, would be held guilty of legal negligence. If a failure on the part of a water works operator to bring his system or his operating practices up to the standards accepted by such a group as this is followed by injury and damage to a consumer of water and that injury is the result of the failure, then the water supply agency would be liable for damages. That is the legal situation now and it should continue to be the situation because we have the legal obligation to provide the facilities and the operating practices which are reasonably needed. No court or jury would ever decide that what this Association deemed to be required by good practice was not reasonably necessary. It is, therefore, vitally important to the members of this Association that nothing be done by the Association tending to indicate that consumers' plumbing and fixtures are or should be under the control of the water supply agency as being part of the water supply system. That is not to say that the water supply agency representatives should be indifferent to sanitary defects on consumers' premises. Where dangerous defects are known to exist or where the water supply operators are in position to know of such defects by exercising ordinary powers of observation and deduction, the water supply operators are in duty bound to take steps to guard against contamination of the general supply. However, there is no legal, or even moral, obligation on a water works operator to undertake the impossible task of inspecting all consumers' premises for sanitary defects. Instead there would, indeed, seem to be a moral obligation to make it plain to all concerned that such inspections are not made and that, so far as the water supply agencies are concerned, the limit of the public water supply system is the property line.

Conclusion

Water works operators must be interested in potential health hazards which may affect the potable water supply. There is a moral responsibility on the operator to use his influence to bring about better plumbing practices. There is a moral responsibility to take necessary action, within his rights and abilities, to remove from the system any and all hazard creating sanitary defects which he knows exist, or should know exist. The water works operator should not let it be presumed that he has promised to perform that which he cannot perform.

VISCOSE RAYON MANUFACTURING WASTES AND THEIR TREATMENT

Part II—Waste & Sewage Treatment

By E. T. ROETMAN
Sanitary Engineer
AMERICAN VISCOSE CORPORATION
MARCUS HOOK, PA.

Part I of this article described the processes of manufacture of Viscose Rayon and the wastes therefrom. It appeared in the July issue.

TREATMENT of the sanitary sewage from a modern rayon manufacturing plant employing one to five thousand persons presents few major difficulties not encountered in treatment of sewage from a small community with an equivalent population.

If only one sewer system has been provided for the plant so that the sanitary sewage is mixed with mill wastes, its successful treatment will be very difficult if not impossible. If separate sewers are provided any treatment satisfactory for a strong sewage may be used.

The operation of a sewage disposal plant in the rayon manufacturing industry differs from normal sewage plant operation mainly in the constant checking and watching that is necessary to forestall the introduction of toxic wastes into the sewer.

Problems in Sanitary Sewage Treatment

Due to the rapid changes that occur in the industry new equipment is constantly being installed. Plumbers connecting this equipment to the sewer system are apt to hook it into the nearest sewer regardless of the type of waste to be removed.

If it happens to be an acid waste and the sewer chosen is a sanitary one, the disposal plant operator may find himself with an incoming sewage with a pH of 3.0 or less. Unless detected and corrected immediately this might ruin plant operation to say nothing of the damage to the plant installation. It has happened a few times and is a constant source of worry to our operators. An experience at one of our plants illustrates this so well it is worth describing in some detail for the benefit of operators who think *they* have troubles.

The Author

During an inspection trip, we noticed that the liquid in the Imhoff tank had a very peculiar color and the concrete and metal showed signs of disintegration. A check revealed a pH of 1.7 in the sedimentation chamber while the four gas vents had pH values varying from 3.0 to 6.0.

All scum had disappeared from the gas vents and the liquid levels in the four gas vents and in the sedimentation chamber were all different. The liquid levels varied directly with the pH, the chamber with the lowest pH had the lowest level and that with the highest pH the highest level. The level of the liquid in the gas vent which had a pH of 6.0 was five inches above that in the sedimentation chamber. The explanation offered is that the specific gravities of the liquids varied with per cent of sulphuric acid present.

As much of the acid was removed as could be drained off and the balance neutralized with caustic soda. The source of the acid was found to be a broken acid sewer at a point near a badly cracked sanitary sewer manhole. This permitted the acid to run into the sanitary sewer and down to the plant.

The broken sewer and manhole were repaired, no more acid arrived at the disposal plant and our problem was solved, or so we thought.

The next day, the sludge pipe dropped into the tank, the spray nozzles refused to function properly and the siphon quit operating. Like the Deacon's one horse shay, everything folded up at once.

An examination of the sludge in the bottom of the tank to determine what effect the acid had on it revealed the complete absence of any sludge. A new method of sludge disposal had been discovered but considering its drastic action on the disposal plant it will not be advanced as a practical solution for sludge disposal.

The tank was pumped dry and repairs made to the piping and various other damaged parts. As no seed sludge was available, the plant had to start from scratch again.

Needless to say daily pH readings are now taken of the incoming sewage at all plants.

Garbage and Dry Waste Disposal

Garbage from the plant cafeterias is collected by neighboring farmers for feeding hogs so does not offer any problem.

The miscellaneous dry wastes such as rubbish, trash, waste paper, unmarketable yarn, etc., are generally disposed of by hauling to a dry dump. At two of our plants, in congested areas, all combustible material is burned in incinerators. Fumes and other products of combustion are carried by stacks to a point sufficiently high to permit their dissipation without creating a nuisance. At the other plants care must be exercised to prevent the dumps from catching on fire as the odor given off by the burning waste causes a deluge of complaints from neighbors. At one plant it is necessary to transport these dry wastes seven miles by railroad in order to dispose of them satisfactorily.

Viscose Waste Disposal

During the manufacturing process some viscose is made which cannot be used because of over age, contamination or other reason, and some is lost at the spinning machine when jets are changed and while finished cakes of yarn are removed from the machine.

This waste viscose was at one time discharged into the sewers where it came in contact with the acid wastes. Its cellulose content precipitated out and upon reaching a quiet section of the river settled to the bottom, cov-

ering the river bed with a slimy grey blanket that killed bottom plant and animal life thus destroying the fish food.

This waste is now collected and hauled to small lagoons or ponds where it has a chance to dry out without creating a nuisance.

Some viscose does get into the sewers when equipment in the viscose department is washed up and also when the filter cloths from the plate filters are washed. When removed from the filters these cloths are saturated with viscose and if placed directly into the washing machine, all of this viscose would go into the sewer with the wash water. But, by passing these cloths through a wringer before putting them into the washing machine the largest portion of the viscose is squeezed out and can be disposed of in the viscose lagoons. The washing time and volume of wash water is reduced to a minimum and some reduction in washing cost is secured.

The waste from the viscose making department and the laundry is alkaline when it reaches the disposal plant. It is neutralized with some of the acid waste to precipitate the viscose and then mixed with the other treated wastes and discharged into the large final settling basin providing a 24-hour detention which is described later.

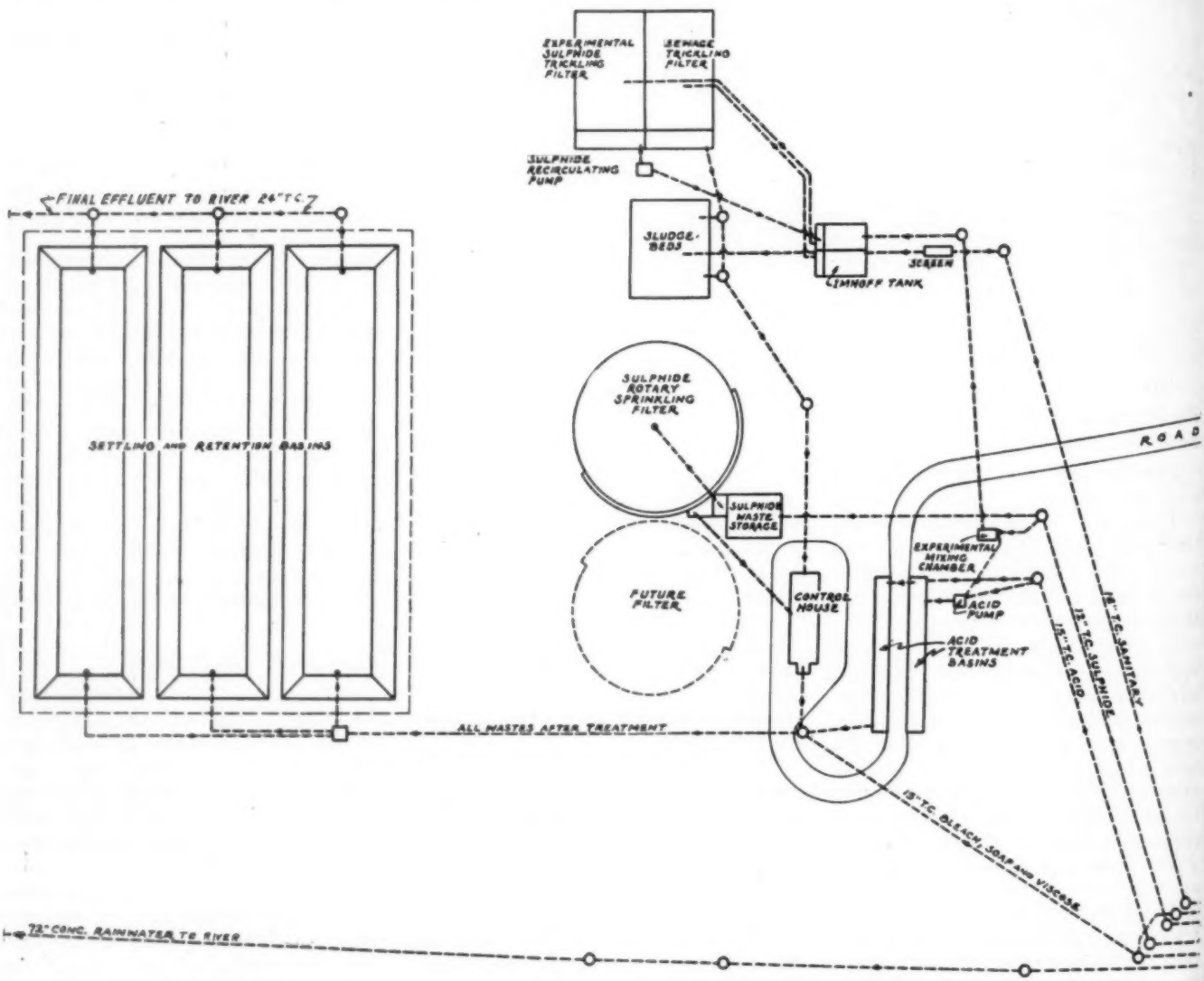
Acid Waste Treatment

The bulk of the acid waste is produced in the first stages of finishing when the precipitating bath liquid which adheres to the yarn is washed off, and in the final washing of the finished yarn when the bleach acid and souring are removed. This waste is composed of a very weak solution containing sulphuric acid, hydrochloric acid, zinc oxide, sugar, sodium sulphide, sodium bisulphate, hydrogen sulphide, carbon bisulphide and other sulphur compounds.

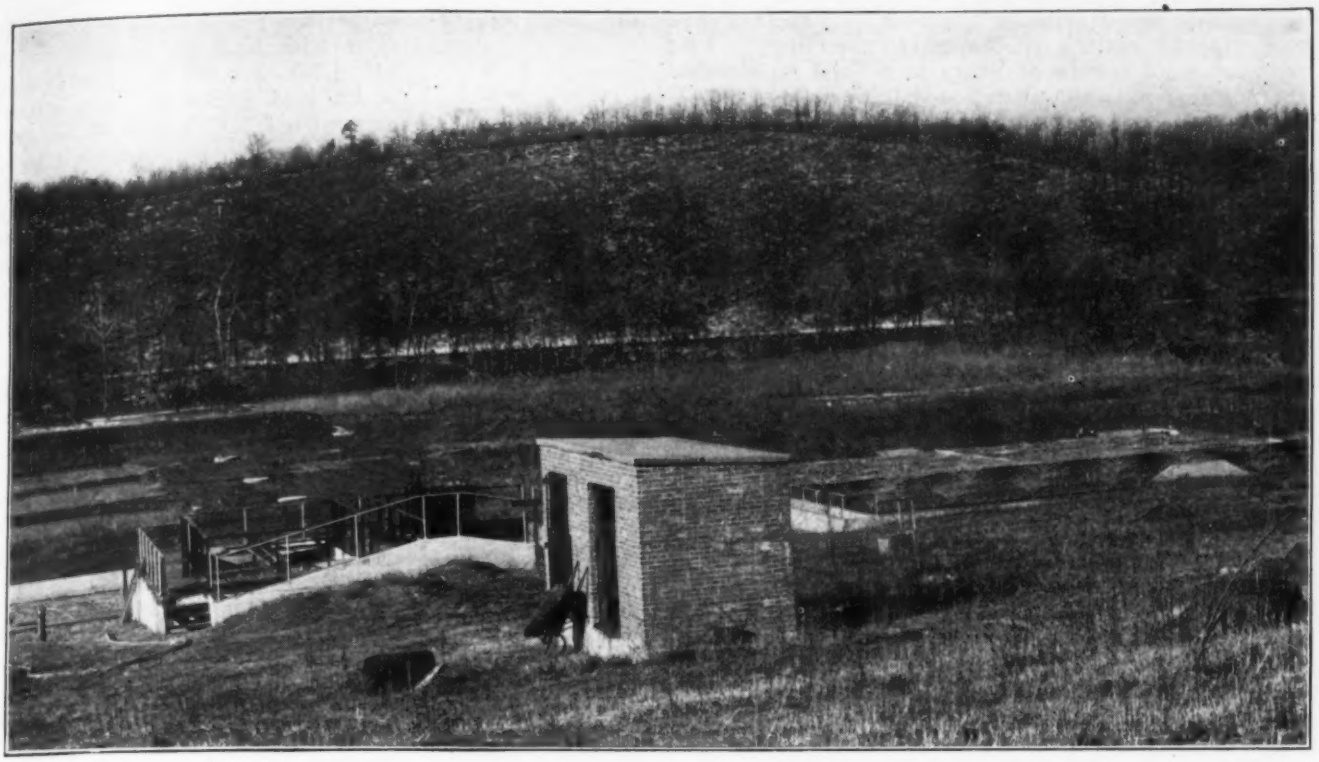
The balance of the acid waste comes from back washing the acid filters, washing up the spinning machines and floors in the spinning room and from washing up equipment and floors in the acid makeup and reclaim departments. These wastes while generally stronger than those from the finishing department are small in volume and are produced for only short periods at a time. These wastes contain the same pollutants as that from the first wash in the finishing department plus dirt and corrosion products (mostly iron compounds) picked up from the floor and equipment.

In addition to these regular and unavoidable wastes, there are always some spills and leaks which individually amount to little but because of their number become quite an important consideration.

The first and most important step in treating the acid waste is one of prevention. By close periodic inspection and maintenance of all piping, valves and equipment to forestall leaks, and by prompt repair of all leaks that do develop, the waste can be kept at a minimum. This not only reduces the cost of waste treatment



Layout of Front Royal, Va., Waste Treat ment Plant of American Viscose Corp.



Sewage treatment unit. Screenhouse in foreground; Imhoff tanks behind. Sludge drying beds to the left; filters to the right. Settling and retention basins, left rear.

but also saves valuable and costly chemicals. At one of our plants a concerted drive on leaks resulted in reducing the acid content of the waste from 0.40 per cent to 0.20 per cent. As the volume of acid waste at this plant averages more than a million gallons per day the savings in chemicals at the treatment plant and in raw materials at the main plant has been very gratifying. This, of course, was an unusual case, but every pound of chemicals kept out of the sewer is a direct saving at both ends, and money and time spent in doing it is a good investment.

Some of the acid waste that reaches the disposal plant is used in treating the sulphide waste and some is used to neutralize the viscose waste.

The treatment of the balance of the acid waste follows the standard practice. It is neutralized with lime or lime stone and then mixed with the other treated wastes, after which it is discharged into the large final settling basin for clarification.

Sulphide Waste Treatment

The first wash in the finishing department removes spinning bath liquid and some of the other impurities that adhere to the rayon but does not remove sulphur. To remove the sulphur the rayon is washed with an alkaline sodium sulphide solution which dissolves the sulphur and carries it away in solution.

The waste from this operation not only contains some of the original sodium hydroxide and sodium sulphide, but in addition, also contains polysulphides, sulphites, thiosulphates and sulphates. This waste has a pH of 10.5 and the relatively high biochemical oxygen demand of 300 p.p.m. which amounts to .0025 pounds of oxygen for each gallon of waste. This makes treatment of this waste imperative if discharged into a small stream.

The easiest and cheapest way to remove this oxygen demand is to neutralize the alkaline sulphide waste with the acid waste. However, this treatment precipitates a very finely dispersed sulphur that is almost impossible to remove satisfactorily by either filtration or settling. The resultant milky effluent, while not nearly as damaging to the stream as the original high oxygen consuming waste, causes many more complaints from the public, who, seeing this discoloration in the river are certain that "the river is being ruined." Explanation by the plant management or state officers fails to convince them that the treated waste they can see is much less damaging than the colorless untreated waste which they could not see.

A different type of treatment was needed to eliminate this source of complaint and still turn out a satisfactory waste effluent. A search in the trade-waste literature revealed the fact that if we wished to use a different treatment we would have to develop it.

Biochemical treatment of these wastes had proven successful for Courtalds in England and at their suggestion, a small experimental trickling filter was constructed. The tests made on this filter indicated that sulphide wastes could be successfully treated bichemically. Using the data obtained from this experimental filter a large filter was designed and installed at our Front Royal, Va., plant. As the breaking in and operation of the large filter was very similar to that of the experimental one, a description of it will suffice for both.

The plant for treating sulphide wastes consists of a 40,000 gallon waste storage tank where the variations in strength and volume of the waste are smoothed out; a 2,250 gallon dosing chamber with a Pacific Flush Tank siphon discharging into a Dorr Rotary Distributor; a circular trickling filter 120 feet in diameter filled with six feet of trap rock; and a 7,000 gallon filtered effluent tank serving as a suction well for two 75 g.p.m. recirculating pumps.

Innoculating and Starting Filter

The starting and operation of this filter should be of interest as the sulphide waste being treated is radically different from any material ever handled by a trickling filter in this country, so it is given in some detail.

The filter was started by pumping well ripened sewage sludge mixed with an equal volume of water into the dosing tank which distributed it evenly over the bed. About 5,000 gallons of sludge was used in this manner to insure a thorough seeding of the bed with bacteria from the Imhoff tank. While this seems a large volume of sludge to dump onto a filter, it actually amounted to less than two gallons per cubic yard and no ponding or plugging of the stone resulted.

The sewer outlet was closed so that all the sludge liquor and diluting water was retained in the suction well. After the initial seeding was completed one recirculating pump was started and the filter operated a day with only this liquor being dosed on it. Sodium hydroxide was then gradually added until the pH of the recirculating liquid had reached 9.0. Care was taken not to change the pH more than one-half a point each day, loss due to leaks and evaporation being made up with clean mill water. During the week in which the pH was being adjusted, 50 pounds of glucose was fed into the dosing tank each day to supply food for the bacteria. (Note: this was in the days before sugar rationing.)

After the pH of the recirculating liquid had been raised to 9.0, a small amount of sulphide waste (5 g.p.m.) was fed into the dosing tank along with the recirculated liquid. The amount of sulphide waste was gradually increased and the amount of glucose decreased until at the end of another week the filter was receiving 80 g.p.m. of sulphide waste and no glucose.

The volume of waste was slowly increased until the filter was being dosed at the rate of one million gallons per acre per day which corresponds to the lower dosing rates for standard sewage filters. The B.O.D. load amounted to 300 pounds per acre foot and the filter removed 90 per cent or 270 pounds. Attempts to increase the loading met with no success. B.O.D. loads up to 600 pounds per acre foot were taken by the filter but B.O.D. removal decreased with increase in loading, being only 250 pounds per acre foot when 600 pounds were applied. Maximum B.O.D. removal occurred when about 300 pounds per acre were applied.

The optimum volume of recirculated effluent was found to be somewhere between 30 and 35 per cent of the volume of raw waste fed the filter.

The filter settled down to uniform operation with a slight reduction in efficiency as the winter months approached. There is nothing new or especially startling in the fact that a trickling filter can remove a fairly heavy B.O.D. load from a waste liquor. The satisfactory treatment of this particular waste by such a method is, however, of interest because it is a chemical solution containing only sodium sulphide and polysulphides. Also of interest is the fact that the waste enters the dosing chamber with a dark amber color and an average pH of 10.5 and leaves the filter with little or no color and a pH of 7.0 when the filter is operating at full load. When the filter is operated with a B.O.D. load 75 per cent or less of maximum capacity, 100 per cent of the B.O.D. is removed and the pH of the effluent drops to 3.5 or less. This means that the bacteria developed in this filter can and do live in an environment which ranges from highly alkaline to very acid.

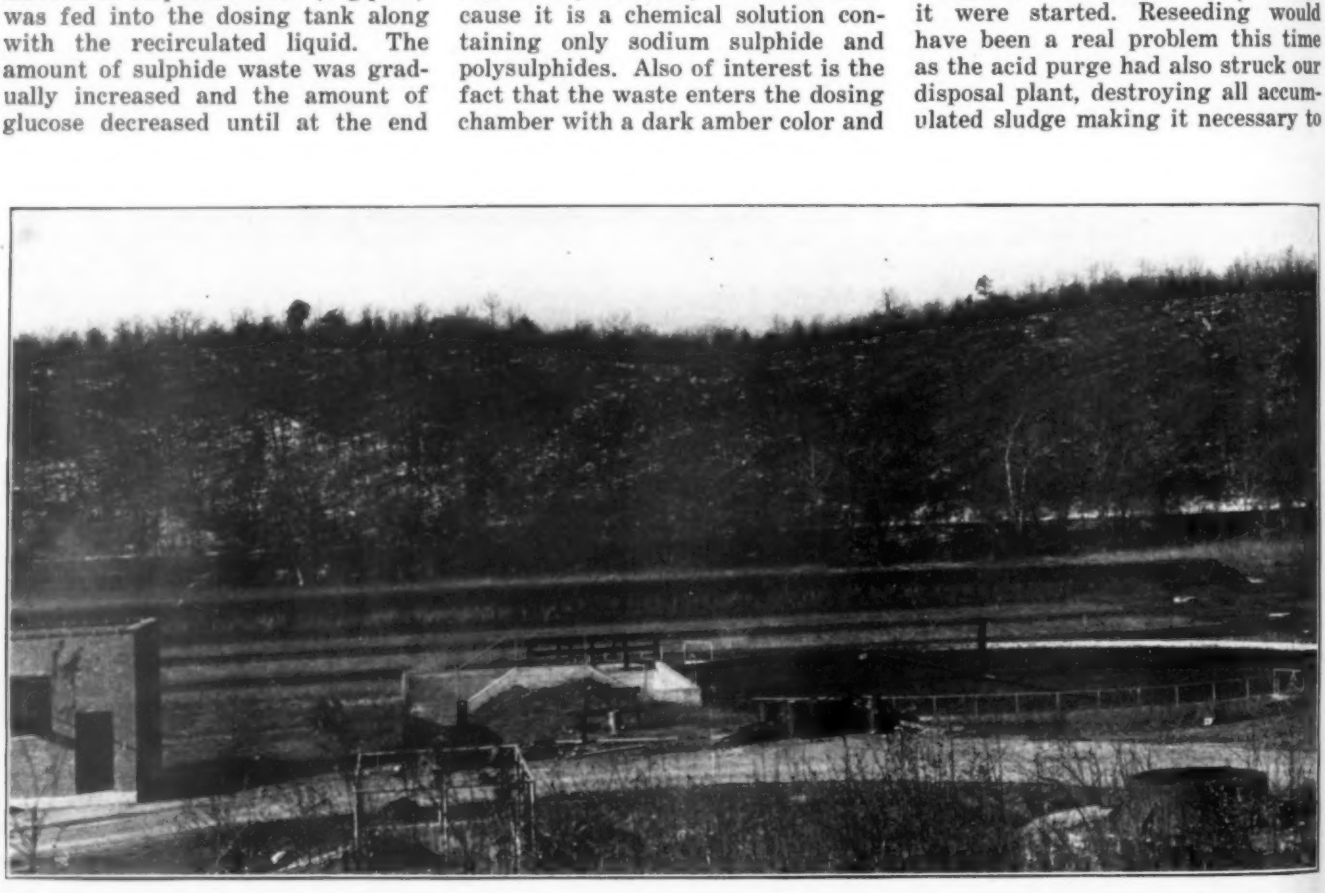
Disaster Strikes Plant

The first week in November last year disaster struck the disposal plant in the form of acid waste everywhere except where it was supposed to be. Its effect on the sewage disposal plant has already been described.

The acid waste from the broken sewer also got into the sulphide waste line. The high alkalinity of the sulphide waste partially neutralized it and no physical damage was sustained by the plant. However, the change in the chemical makeup of the solution going onto the filter "blitzkrieged" our carefully nurtured bacterial colony.

The efficiency of the filter dropped to zero and a very pronounced unloading of the surface film occurred.

It was thought that the filter would have to be reseeded with sewage sludge and arrangements for doing it were started. Reseeding would have been a real problem this time as the acid purge had also struck our disposal plant, destroying all accumulated sludge making it necessary to



Sulfide treatment unit. Control house, left. Rotary filter, right. Three settling and retention basins in background.

obtain sludge from some outside source. The state health authorities were asked to advise us of the nearest sewage disposal plant from which well ripened sludge could be secured. This proved to be at a town more than forty miles distant, which would make transportation of several thousand gallons of sludge a difficult and costly job.

During the time spent in locating a supply of sludge and making arrangements to get it to the plant, the acid line had been repaired and the sulphide waste had returned to normal. The pump suction well was filled with this raw sulphide waste and the recirculating pumps started so liquid could be distributed on the bed to wash out any remaining acid and to keep the little film that was left on the rocks moist.

By the time all arrangements had been made for hauling in sludge and reseeding the filter, the waste being recirculated had lost some of its color.

Blessing in Disguise

Hoping that this loss of color was an indication that some of the bacteria had escaped the acid attack, reseeding of the filter was postponed and recirculation of the waste continued with the addition of very small quantities of fresh waste. Our hopes were realized, how well we did not know until several weeks later when the carefully and gradually increased load had reached 300 pounds of B.O.D. per acre foot with a B.O.D. removal of about 98 per cent. This recovery of the filter occurred during the coldest weather of the year, when air temperatures hovered around zero. As spring approached and temperatures increased, the load on the filter was stepped up until it was about 2 million gallons per acre per day with an average B.O.D. load of 500 pounds per acre foot. B.O.D. removal reached practically 100 per cent at times and seldom dropped below 95 per cent.

What appeared to be a major calamity had turned out to be a blessing in disguise. Several strains of bacteria capable of living on the sulphide waste had probably been developed from those present in the sludge used for seeding. These bacteria, while living in the same environment evidently interfered with each other to such an extent that those best able to stabilize the waste were prevented from reaching maximum numbers. The acid must have killed the least useful ones, permitting the others to increase until the filter was handling almost double the load.

The types of bacteria living in the filter are not known at the present time, but we hope to isolate and identify them sometime in the future. This information would be interesting and might have some value. The important thing about them is one we now know — they reduce the B.O.D. of the waste.

The large 120-foot filter is now capable of treating most of the sulphide waste during the warm months. What it will do in cold weather is not known. To increase capacity for treating sulphide wastes, a standby unit of the sewage disposal plant was changed over to a sulphide treatment plant. As the Imhoff tank could be used for a waste storage basin and the dosing tank and filter used as constructed, the only construction necessary to make this change was the laying of a sewer line to the Imhoff tank and the installation of a recirculating pump with its suction well and housing.

Large Scale Experimental Plant

While these changes were being made, it was decided to add a baffle type mixing chamber, an acid pump, a sewage pump and several weirs. We now have a full size experimental plant with a 4,600 square-foot filter with six-foot stone depth.

The lay-out is so arranged that this filter can be operated exactly as the large filter with only sulphide waste and in addition, any mixture of sulphide waste and acid waste, or sulphide waste and sewage or a combination of all three can be treated.

Experiments carried out so far indicate that effluent of the Imhoff tank handling sanitary sewage only can be added to the sulphide waste in small quantities without adversely affecting the stabilization of either although no increase in B.O.D. reduction capacity is gained.

The most valuable experiment conducted so far was the addition of enough acid waste to the sulphide waste to lower its pH to about 8.0. When this was done the filter was able to take a B.O.D. load of 1050 pounds per acre foot and remove every pound of it. In this experiment the maximum capacity of the dosing siphon was reached but not that of the filter so it is not known what maximum B.O.D. load a trickling filter treating sulphide waste can handle if the pH of the waste is properly adjusted.

We do know, however, that we can double the capacity of our larger filter by pH control and that the capacity of the treatment plant at Front Royal will be ample for a long time to come.

Provision for pH control in future disposal plants will enable us to save 50 per cent on installation costs. In the construction of trickling filters this is a sizable item.

Polishing of Effluent

Before the effluent from any part of the waste disposal plant is permitted to go into the river, it receives a final polishing in the secondary settling and retention basin. The dual name settling and retention basin very adequately describes the function of this part of the plant.

As a settling basin it removes the suspended material from the viscose waste, the products of neutralization and other suspended material from the acid wastes and the material that sloughs off of the filters treating sewage and sulphide waste.

As a retention basin it has a capacity in excess of the total volume of all wastes produced in 24 hours and acts as a safety valve retaining any unusually heavy discharge of acid waste that might escape through the disposal plant at night when no operator is in attendance. There may be times when a bad break in the acid system might occur and not be detected until several thousand gallons of acid are lost into the sewers. It is easy to imagine what a few thousand gallons of concentrated acid would do to the plant and animal life of a small stream before its strength was dissipated. If this happens in the day time, adjustments at the disposal plant can be made to neutralize it. But should it happen at night when no operator is in attendance and when the plant is set for average strength waste, it will go through the plant with very little change.

It is for just such emergencies which have occurred, but fortunately at very infrequent intervals, that this large basin is used. As it takes more than 24 hours for the waste to go through the basin a daily check by the operator will detect any such slug of acid which has been lost. It can then be neutralized, in the basin where it is, or at the outlet as it leaves the basin.

Provision has also been made to chlorinate the effluent of the sewage trickling filter and the sulphide trickling filter should the condition of the receiving stream require it.

RESULTS OF EFFLUENT CHLORINATION AT CLEVELAND

By JOHN J. WIRTS
Superintendent
EASTERLY SEWAGE TREATMENT PLANT
CLEVELAND, OHIO

DURING each summer, a bacteriological and microscopic analysis of water from seven bathing beaches on Lake Erie adjacent to the Easterly Sewage Treatment Plant of Cleveland, Ohio, is conducted as part of the regular laboratory routine.

Table 1 shows the combined yearly average figures and per cent reduction of total bacteria and Coliform Bacteria, expressed as the Most Probable Number per ml., for the six beaches from East 140th to East 185th Street. The median figures in the table are the arithmetical averages of the yearly medians for the six beaches.

These six beaches were combined into one table because they all showed similar results, and because they are all affected by the Easterly Plant effluent. From the outfall, which empties at lake level beyond a breakwall about 1,000 feet from the shoreline, the lake current and the prevailing winds normally carry the effluent in an easterly direction, after considerable diffusion. It can be stated with a reasonable degree of certainty that the very great improvement in the bacterial quality of the East shore waters is due solely to the efficient operation of Easterly Sewage Treatment Plant and consistant chlorination of the effluent.

During the summers the effluent is chlorinated sufficiently to maintain a residual of from 0.5 to 1.5 p.p.m. The total bacteria count in the chlorinated effluent averages about 50 and the Coliform Bacteria are always zero.

Quality of Lake Water in the Effluent Stream

During 1941, three series of ten samples each, taken at various points, 100 feet apart, in the effluent stream in the lake, were analyzed bacterially and chemically. The accompanying tables 2, 3, 4 show the results.

The figures for percent effluent in the samples were arrived at as follows: The chlorides were determined on one series of twenty-four samples of lake water at various points along the shore and the breakwall, and at other points from 100 to 1,000 feet from shore, all points distinctly outside the effluent stream. The average of these determinations was taken as the chloride content of the lake water for all three series of tests. The chloride in the effluent at the time of sampling was known. The chloride on each of the ten samples was determined. Then, by a simple calculation, the percent effluent and lake water in the samples was determined.

These tests showed that the effluent was not only much cleaner than shore water of the lake, but, due to long-lasting chlorine residual, was having a pronounced sterilizing effect on the adjacent lake water. This effect was reflected in the surveys of water quality along the beaches.

In calm weather, the effluent stream flows north for about 400 feet and then diffuses over a large area. The general direction of flow after that is toward the east.

In the three years the plant has been operating a 91 per cent reduction in pollution of the bathing beach waters has been effected. Although the lake is receiving a certain amount of polluted water from several small streams the bacterial content of the beach waters is within the upper limits of that recommended by the City of New York for bathing waters.

Ordinarily one would assume that every state would have a definite set of standards for shore bathing waters, similar to those of New York and Connecticut. However, at the time of the preparation of this report, Ohio did not have any published standards.

TABLE 2
QUALITY OF WATER IN EFFLUENT STREAM IN LAKE
(JUNE 30, 1941)

Sample No.	1	2	3	4	5	6	7	8	9	10
Percent Effl. in Sample	38	38	5	1	7	7	2	2	0	7
Residual Chlorine	0.2	0.2	0.1	0.1	0.1	Tr.	Tr.	Tr.	0	Tr.
Total Bact. Per Ml.	33	11	6	15	10	175	13	7	90	9
Coliform Bacteria Per Ml.	1	0	0	0	0	0	0	0	0	0
Coliform Bact. Per Ml. (MPN)	24.0	0.8	1.7	0.8	0.8	1.7	0.8	0.8	6.0	0.8

TABLE 3
QUALITY OF WATER IN EFFLUENT STREAM IN LAKE
(JULY 21, 1941)

Sample No.	1	2	3	4	5	6	7	8	9	10
Percent Effl. in Sample (1)	89	28	43	30	26	26	23	4	26	26
Residual Chlorine	0.1	0.2	0.3	0.15	0.15	0.1	0.05	Tr.	0.15	0.15
Total Bact. Per Ml.	132	79	15	34	36	31	43	61	45	19
Coliform Bacteria Per Ml.	0	0	0	0	0	0	0	0	0	0
Coliform Bact. Per Ml. (MPN)	13.0	1.7	0.8	0.8	1.7	0.9	1.7	1.7	0.8	0.8

TABLE 4
QUALITY OF WATER IN EFFLUENT STREAM IN LAKE
(AUGUST 29, 1941)

Sample No.	1	2	3	4	5	6	7	8	9	10
Percent Effl. in Sample	100	48	21	20	14	14	13	16	16	14
Residual Chlorine	1.0	0.25	0.25	0.25	0.25	0.25	0.25	0.3	0.2	0.2
Total Bact. Per Ml.	13	42	26	27	21	18	26	20	25	23
Coliform Bacteria Per Ml.	0	0	0	0	0	0	0	0	0	0
Coliform Bact. Per Ml. (MPM.)	0.8	1.7	0.8	0.8	0.8	0.8	0.8	1.7	0.8	0.8

Note: Total Count—Agar 37½°.
(MPN) = Most probable numbers.

TABLE 1
BACTERIOLOGICAL STUDIES OF WATER FROM SIX BATHING BEACHES—CLEVELAND, OHIO

	Yearly Averages				Percent Improvement Over 1938		
Year	1938*	1939	1940	1941	1939	1940	1941
Total Bacteria Per Ml. 37½°							
Average	30,000*	2800	3500	2400	91	88	92
Median	16,000	1600	3000	1900	90	81	88
Coliform Bact. Per Ml., M.P.N.							
Average	744*	148	94	73	80	87	90
Median	200	30	30	29	85	85	86

* 1938 Samples taken before Easterly Plant was in full operation.

NYSSWA ANNUAL SPRING MEETING

APPROXIMATELY 100 members and guests attended the annual Spring meeting of the N. Y. State Sewage Works Assoc., held in Syracuse, N. Y., on June 16-17. Possibly the attendance would have been larger had there not been an unavoidable conflict with the last day of the AWWA Meeting in Milwaukee. As it was, there were a number of the faithful who left the AWWA meeting either prior to or during its banquet in order to be in Syracuse the next afternoon.

President
William H. Larkin
Dist. Engineer
State Health Dept.
New York City

Award Winner
Uhl T. Mann
Supt. of Sewage
Ley Creek Plant
Syracuse, N. Y.

General arrangements for the meeting were under the direction of a committee of the Central Section of NYSSWA, composed of J. M. MacCrea, Dist. Mgr., Johns-Manville Co., Uhl T. Mann, Supt. of Ley Creek Sewage Plant, and H. H. Wagenhals, Dist. Engr., N. Y. State Dept. of Health, all of Syracuse.

Awards

These annual Spring meetings are always featured by the presentation of award for the best annual report of the year and for the best gadgets submitted at the meeting.

Winner of the cup for the best annual report of 1943, as determined by the Rating Committee, was Uhl T. Mann, for his report as Supt. of the Cortland, N. Y. plant. In presenting the cup, the chairman of the Rating Committee, A. W. Eustance, said that Mr. Mann was the first person eligible to win the award twice inasmuch as since last year he has become the Supt. of another plant within the state (Ley Creek, Syracuse).

Certificates were awarded to Gadget Contest winners as follows: First place, for a lime slaking machine, to Harold R. Fanning, Supt. of Sanitation at Bendix Aviation Corp., Elmira, N. Y.; second place, for a sludge sampler, to Alexander S. Zeley, Belmont Lake State Park, Babylon, N. Y.; third place, for a sludge sampler, to Byron Evans, Pine Camp, N. Y.

Thursday Morning Technical Session

Papers by Channel Samson, Supt. Sewage Treatment, Town of Tonawanda, N. Y.; Fred J. Biele, Cons. Engr., Huntington, L. I.; and William D. Denise, Supt. of Water and Sewer Depts., Town of Greece, N. Y., filled the opening session.

Mr. Biele spoke on "Overcoming Ground Water Difficulties in Sanitary Construction," and stressed the need for test borings.

In the paper on "Operation of a Mechanical Aeration Activated Sludge Plant," Mr. Denise told the audience that bulking at his plant had been eliminated by aerating the effluent of the primary tank before the addition of the return sludge.

Hazards in Sewage Plants

In a paper on "Safeguards against Hazards in Sewage Treatment Plants," L. L. Langford, Eastern Mgr., Pacific Flush Tank Co., New York City, compared the accident rates at sewage plants with those in other industries pointing out that when reduced to a comparable basis the accidents in sewage plants were higher than in industrial plants.

Using slides to illustrate the effects of explosions, and other phases of the problem, Mr. Langford gave a thorough-going review of this very important part of sewage treatment plant operation. Mr. Langford also referred to the Federation Committee which is preparing a manual on this subject.

"Post War Plans for Sewage Disposal Projects in N. Y." were explained by Earl Devendorf, Asst. Dir., Div. of San., N. Y. State Dept. of Health. Indicating that sewage treatment plants are among the most important things to consider in post war plans, Mr. Devendorf gave many of the details of the post war planning legislation, policy and procedure in the state.

"The Operation of a Wartime Industrial Sewage Plant" was the title of the paper presented by Harold Fanning, Supt. of San., Bendix Aviation Corp., Elmira, N. Y. The paper emphasized the need for designing for peak loads in this type of industrial sewage treatment plant which treats only the sanitary waste of the employees.

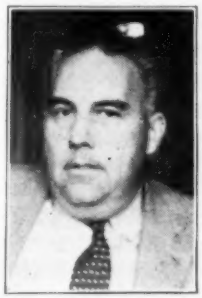
Sludge Disposal Discussion Period

The annual Sunrise Breakfast of the NYSSWA was a wartime casualty and instead of the usual Question Box following the breakfast, a "Controlled Discussion Period" was held on the subject of "Sludge Disposal."

Under the leadership of F. Welling Gilcreas, Asst. Dir., Div. of Labs., N. Y. State Health Dept., Albany, prepared discussions were given as follows: "Disposal of Raw Sludge," by William D. Denise, Supt. of Water and Sewer Dept., Town of Greece, N. Y.; "Digestion in Imhoff Tanks," by Glenn Searles, Supt. of Sewage Treatment, Rochester, N. Y.; "Digestion in Separate Tanks," by Charles R. Velzy, Cons. Engr., Greeley and Hansen, Engrs., New York City; "Vacuum Filtration," by Uhl T. Mann, Supt. of Sewage Treatment, Syracuse, N. Y.; "Drying on Sand Beds," by C. L. Walker, Prof. of Civ. Engr., Cornell Univ., Ithaca, N. Y., and "Disposal of Dewatered Sludge," by A. W. Eustance, Dist. Engr., N. Y. State Dept. of Health, Geneva, N. Y.

Among the various problems and ideas brought out by persons in the audience during the discussion of these papers were those concerned with the variation in raw sludge making its control in incineration difficult; complication of sludge incineration by waste activated sludge; effect of copper on digestion; and effect of other chemicals on digestion. Unfortunately time did not permit full discussion of the papers, which though short in themselves were good and provocative of interested discussion.

(G.E.S.)



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The Editor's Comments

Water Works Depreciation and Accounting Practices

IN this issue are two worthy articles dealing with assumed vs. actual depreciation of water works structures, and with accounting practices of municipal vs. privately owned water utilities in amortizing an assumed depreciation.

Hardly could there have been chosen two better qualified engineers to present the several sides of the depreciation accounting practice picture before the Am. Water Works Association than Messrs. N. T. Veatch and L. R. Howson, two consulting engineers with country wide experience in valuation and rate cases in the public and privately owned water utility field.

In analyzing the context of the Veatch and Howson papers it is pointedly evident that a serious weakness (incidentally one which the financing fraternity of the country has severely criticized the water works management fraternity for), is the notable lack of any real uniformity in municipally operated water utility accounting policies and practices. By the financing fraternity the municipal water utility group has been likewise often questioned as to why water rate structures are so amazingly lacking in uniformity.

The banking and legal groups find this situation even harder to understand when applying yardsticks, only to find that even when the physical conditions, population served, power rates, etc., are reasonably similar that still accounting practice and rates are lacking in any real uniformity of pattern or financial results. Furthermore, there is sparsity of uniformity even between water utilities in the same state, on the same stream, or even when close neighbors. In the latter category they do find the greatest degree of uniformity as applied to rate structures. The explanation seems to be that rates are more commonly based on what other water utilities of the same area are charging than on any technical or basically sound economic pattern which publicly financed utilities might be expected to follow out. This is the financing groups opinion, and with some grounds therefor.

All of this points to but one thing—the recognizable need for some semblance of uniformity in accounting and rate making in the municipal water works field. What has been evident through the Veatch survey of municipal depreciation accounting practices, and from other observations, is that the Manual of Water Works Accounting produced through a joint enterprise of the Municipal Finance Officers Ass'n. and the Am. Water Works Ass'n. has not been put to the degree of use contemplated in its expensive production—namely, developing greater uniformity in municipal water works accounting practice. This observation can be somewhat confirmed in the disappointing purchases of copies of this Manual, on which the two cooperating associations spent many dollars and many man hours of authoritative compilers.

It would seem that AWWA still has ahead a real undertaking in the direction of fostering and securing at least a degree of uniformity in water works accounting practices. Admittedly the road is a long and tortuous one so long as there remains any political expediency in water works financing. However, this problem should not constitute a barrier to a start toward the goal of uniform accounting practices.

In the end it may take such regulatory agencies as the Utility Commissions of Wisconsin and Maine to bring about the results sought by AWWA and MOFA in developing the Water Works Accounting Manual. Seemingly this guide has mostly constituted an addition to most publicly-operated water utility libraries about the country—and there have been disappointingly few even to make this much use of the Manual. For those interested, copies are still on sale by the AWWA—address, 500 Fifth Ave., New York (18), N. Y.

In mentioning the Wisconsin and Maine Utility Commissions, what these agencies have accomplished in the direction of securing improved accounting, financing and rate making practices by the municipal water utilities of their respective states is worthy of note. In this attainment the Water District law of Maine and the growth in the establishment of time tested Trustee managed Water Districts in the state (constituting separate political utilities from the municipalities or unincorporated areas served), has proved a sound and effective means of getting good business management into publicly financed water works. Some of these Districts are "burying" their surplus earnings but can proceed only just so far in this direction under the Maine Water District Act, which makes accounting practices subject to Utility Commission review and regulation. A good example of what this means is the recent general rate reduction by the Augusta Water District, which over a period of years had followed a sound accounting practice, strengthened its system from surplus earnings, and now finds that any further plowing back of growing surplus would be too fictitious to justify the practice.

Returning to depreciation accounting, it is Mr. Veatch's opinion that the depreciation rate is too high in most municipal water departments, primarily for the reason that the straight-line theoretical method is used in arriving at assumed depreciation, whereas an engineering appraisal is the only basically sound method of developing an actual depreciation debt rate. The so-called straight-line method seems unsound, in that it produces a surplus reserve fund which has nothing to support it other than a theoretical assumption. As Howson puts it, the straight-line process is one of amortization only. It really is a method of simplifying bookkeeping, rather than establishing a justified cumulative reserve based on observable fact. What it leads to is surplus grabbing by administrations for use in other municipal functions.

While their problems are not the same, it does seem that practices in depreciation accounting by publicly owned water utilities should not be widely different from those of privately owned water utilities—but they are. The natural question is why? The most likely answer is given by Messrs. Veatch and Howson in support of their pleas for a greater semblance of uniformity in water utility accounting practices, and the use of factual engineering appraisal in developing sound financial management in the public water supply. field.

When bankers, lawyers and engineers agree that municipal water utility accounting is in a criticizable condition, isn't it time to kick mere expediency out? There is no better way than via the uniform accounting route.

L. H. Enslow

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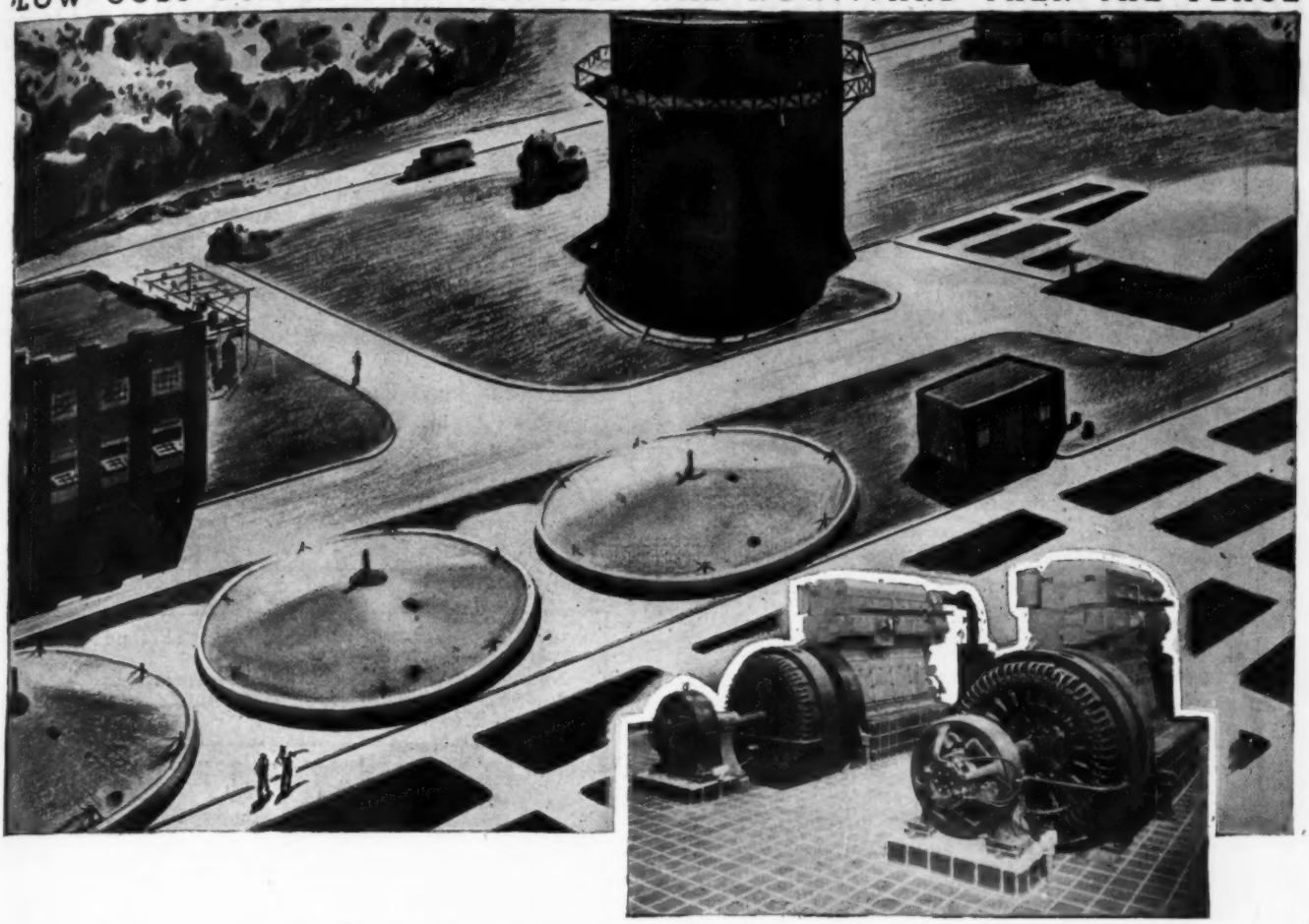

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MEETINGS SCHEDULED:

Aug. 29—COLUMBIA, PA. (Columbia Water Company).
Penna. Water Works Operators' Assn. (Eastern Section). Sec'y-Treas., I. M. Glace, 22 South 22nd St., Harrisburg, Pr. (Aug. 28—Golf afternoon, and Getogether Far East Inn evening.)

Sept. 12-13—BISMARCK, N. D. (Grand Pacific Hotel).
North Dakota Water & Sewage Works Conference. Sec'y-Treas., K. C. Lauster, State Department of Health, Bismarck, N. D.

Sept. 13—WORCESTER, MASS. (Hotel Bancroft).
New England Sewage Works Association. Secretary, LeRoy W. Van Kleeck, State Dept. of Health, Hartford, Conn.

Sept. 13-14—PITTSBURGH, PA. (Roosevelt Hotel).
Western Penna. Section A.W.W.A. Sec'y-Treas., E. P. Johnson, 418 Flannery Bldg., Pittsburgh, Pa. (Joint Meeting with Western Penna. Section of Penna. Water Works Operators' Association.)

Sept. 19-20—WATERTOWN, S. D. (Lincoln Hotel).
South Dakota Water & Sewage Works Conference. Sec'y-Treas., Glen J. Hopkins, State Board of Health, Pierre, S. D.

Sept. 19-22—POLAND SPRING, ME. (Poland Spring House).
New England Water Works Association. (Annual Meeting.) Sec'y, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

Sept. 21-22—DENVER, COLO. (Cosmopolitan Hotel).
Rocky Mountain Section A.W.W.A. Secretary, O. J. Ripple, Superintendent Filtration, R.F.D. No. 2, Littleton, Colo.

Sept. 24-27—ST. PAUL MINN. (Hotel St. Paul).
American Public Works Congress. (Annual Meeting). Executive Director, Frederic Bass, 1313 East 60th St., Chicago, Ill.

Oct. 3-5—NEW YORK, N. Y. (Hotel Pennsylvania).
American Public Health Association. (2nd Wartime Conference.) Chairman, Reginald M. Atwater, M.D., 1790 Broadway, New York, N. Y.

Oct. 12-14—PITTSBURGH, PA. (Hotel William Penn).
Federation of Sewage Works Associations, Exec. Sec'y, W. H. Wisely, Illinois Building, Champaign, Ill.
and
Penna. Sewage Works Association. Sec'y-Treas., Bernard S. Bush, Kirby Health Center, Wilkes-Barre, Pa. (Joint Meeting with Fed. Sew. Wks. Assns.)

Oct. 17-19—AUSTIN, TEXAS (Hotels Austin & Driskill).
Southwest Section A.W.W.A. Sec'y-Treas., George J. Rohan, P. O. Dr. 449, Waco, Texas.

Oct. 23-24—KANSAS CITY, MO. (President Hotel).
Missouri Valley Section A.W.W.A. Sec'y-Treas., E. L. Waterman, 104 Engineering Hall, University of Iowa, Iowa City, Ia.

Oct. 24-26—LOS ANGELES, CALIF. (Biltmore Hotel).
California Section A.W.W.A. Secretary, Blair I. Burnson, P.O. Box 720, Oakland 4, Calif.

Oct. 26-27—PARKERSBURG, W. VA. (Chancellor Hotel).
West Virginia Section A.W.W.A. Secretary, J. H. Harrington, Director, Div. of Sanitary Engineering, State Dept. of Health, Charleston 5, W. Va.

Oct. 30-31—PITTSBURGH, PA. (Hotel William Penn).
Engineers' Society of Western Pennsylvania. Chairman, H. M. Olson, Hotel William Penn, Pittsburgh, Pa.

Nov. 2-4—ATLANTIC CITY, N. J.
New Jersey Section A.W.W.A. Sec'y, C. B. Tygert, Dist. Mgr., Wallace & Tiernan, Inc., Box 178, Newark, N. J.

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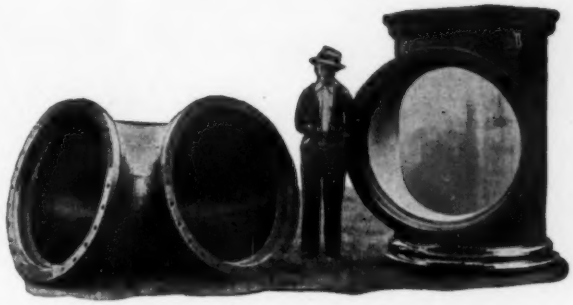

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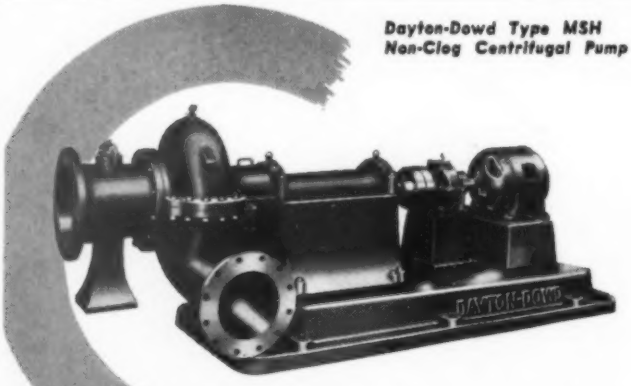

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Here and There with Doc Symons

ONE of our friends asked us what we did on our lunch hour inasmuch as he never sees us in any of the local sandwich emporiums or sticking nickels in a slot and watching a piece of pie pop out. We had to confess that we eat at our desk, munching on a prize package from a nearby delicatessan while reading such sterling publications as the Official Gazette of U. S. Patents, (at least once a week) or perusing one of the many house organs that come across our desk. So many of the latter are of interest that we recently made a list thinking some of our readers might find them of interest too.

The list is probably not complete, but additions will be made as we are brought up to date. Not all of the publications herewith are completely or even directly connected with water works and sewerage but practically all of them at one time or another have touched on our field. Herewith the first third of the alphabetical listing.

Aluminum News Letter—
Aluminum Co. of America, Pittsburgh, Pa.
Bitumastic Bulletin—
Wailes Dove-Hermiston Corp., Westfield, N. J.
Building Maintenance—
Truscon Laboratories, Inc., Detroit, Mich.
C-I Pipe News—
Cast Iron Pipe Assoc., Chicago, Ill.
Fasteners—
Amer. Inst. of Bolt, Nut and Rivet Mfgs., Cleveland, O.
F-M News—
Fairbanks-Morse & Co., Chicago 5, Ill.
Flow Line—
Merco-Nordstrom Valve Co., Pittsburgh, Pa.
H_2O
Water Utilities Service Corp., New York, N. Y.
Heat Engineering—
Foster Wheeler Corp., New York, N. Y.
Hercules Record—
A. Leschen & Son Rope Co., St. Louis, Mo.
H-O-H—
D. W. Hearing Co., Chicago, Ill.
Instrumentation—
The Brown Instrument Co., Philadelphia 44, Pa.
Lead—
Lead Industries Assoc., New York 17, N. Y.
Link-Belt News—
Link-Belt Co., Chicago, Ill.
Lubrication—
Texas Co., New York, N. Y.

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News Makers: Lt. Col. A. S. Behrman, San. Corps, formerly Director of Research for Infilco, has returned to inactive duty (reserve) and has become Vice-President and Director of Research of the Velsicol Corp. of Chicago.—Charlie Bechert, Secy. of the Ind. Sect. AWWA, was quoted in an article in the Saturday Evening Post on Ground Water Level recession. Charlie should know whereof he speaks as the sizable and productive project of studying ground water levels in Indiana is under his direction.—Eben Lufkin, well known meter salesman in the New England area, became associated with the Red Hed Manuf. Co. of Boston, Mass., on Aug. 1.—C. V. "Shorty" Swearingen (another product of the Ill. State Water Survey) and chief chemist of the Chattanooga City Water Co. has patented a refrigerated continuous automatic sampler for collecting twelve two hour composite samples for bacterial analysis. Contrary to the AP story on the patent, the machine does not test the water continuously but it sounds like a good sampler.—What we're waiting for is a machine into which you pour a sample, turn a crank and the typewritten analysis comes out.

* * *

Welcome Back Dept.: We note with some degree of satisfaction, the return to the land of the living of "The Digester," one of our favorite mimeograph magazines. The Di-

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We invite your inquiries

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gester, published by the Illinois Dept. of Health, was a war casualty, no issues having appeared since Sept. 1941. We also welcome back to civilian life, the one and only "Jonesy" (Frank Woodbury Jones) who for the past 15 months has been in the uniform of the USPHS.

* * *

Speaking of "The Digester," of Illinois we note that it contains, under the title "Sewage Gas—A Word of Warning," a recitation of two serious accidents (one resulting in two deaths) around sewage pumping stations in Illinois. The article contains some sound advice on precautions on the prevention of such accidents.

By a strange coincidence, just a few days before the Digester arrived, there came in the mail a mimeograph report entitled, "Gas Hazards in Sewerage Systems and Sewage Treatment Works—Reflecting Experience in Ohio." This 11-page report prepared by A. Elliott Kimberly, principal assistant engineer of the Ohio Bd. of Health, contains these words by F. H. Waring, Chief Engineer, "It is my belief that a copy of this article should be placed in the hands of all municipal officials of this state charged with the responsibility of constructing, maintaining, and operating sewerage systems." It wouldn't hurt a few hundred other persons in other states to see it either.

Coincidence No. 2: Almost in the same mail was the "Official Bulletin" of the No. Dakota Water and Sewerage Works Conference, and what do you think we found in it? —You guessed it—four pages discussing "Gas Hazards in Sewerage and Sewage Treatment Works." And from what did the "O. B." quote—you're right again—From the Ohio report. It must be good if Ken Lauster quotes from it.

* * *

How do you pronounce it Dept.! Lt. Col. Jack J. Hinman (a big man in the sanitary engineering field if we ever saw one) sent us a clipping from the Woman's Home Companion. Under the title "Needling the Enemy," the clipping reads, "AWVS stands for something besides American Women's Voluntary Service now for that organization has a patriotic project with the slogan, 'America Wants Victory Sewers'. . ."—In Milwaukee at the AWWA Convention we took a picture of a sign in one of the Hotel Schroeder shop windows, reading "Wanted Sewers—apply within."—How do *you* pronounce it?

What's New: Those of you who are plagued by poison ivy either on your property or on yourself will be interested to know that there is a new chemical on the market and it will positively kill poison ivy permanently with one spraying application. Will also kill ragweed for the benefit of the Hay fever boys. And if you live in Illinois where the Canadian Thistle is Forbidden, you may also be interested in this result from research.

* * *

From the News Scripts of Chemical and Engineering News of the American Chemical Society comes this definition: "A Bureaucrat is a fellow who spends an entire life building up a file to prove he did not do it."

* * *

A letter from Clinton L. Bogert, who is working under Dean Saville's joint committee on a Glossary of Terms for Water Control Engineering, points out that in the May issue of W.W.&S. the review of current patents gave him a new phrase for the glossary, for under Comminutor, it referred to an *education* passage. Sorry, our typewriter has too many "a's" on it and one of them slipped in.

MANUFACTURERS' *and* EQUIPMENT News

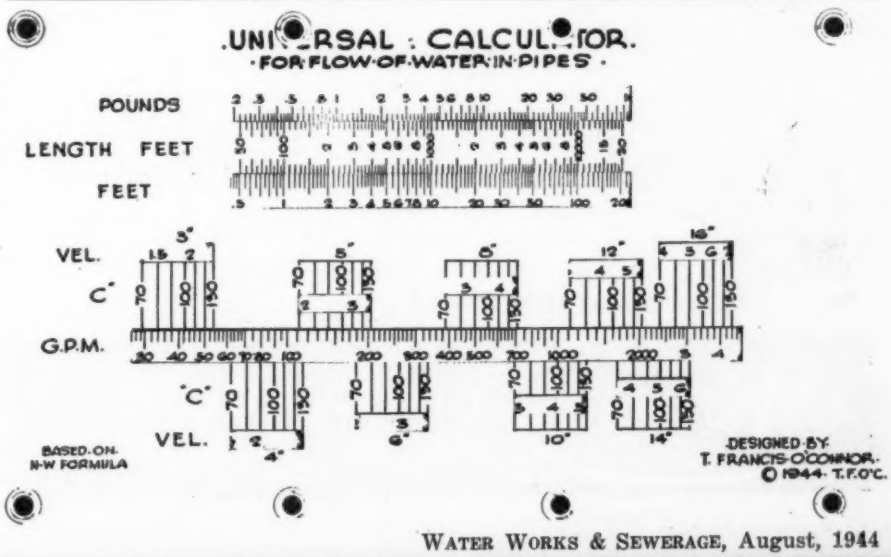
A Universal Calculator

Designed by T. Francis O'Connor and issued by the Grinnell Co. of Providence, a new and novel Universal Calculator for the Flow of Water in Pipes is available for the asking.

According to the information on the reverse side of the Calculator it is designed to show simultaneously all hydraulic factors usually required in water works problems. Of heavy cardboard construction this unique multiple slide rule, about 4x7 in. offers a ready means of determining length of pipe, size of pipe, coefficient of pipe, flow in gpm., velocity of flow, pressure loss in given length of pipe, and total head loss in feet.

The calculator may be set to show the flow through a certain size pipe with the desired coefficient; knowing the length of the pipe it is possible to read all other factors with-

PEERLESS PUMP DIVISION of Food Machinery Corporation
301 W. Avenue 26, Los Angeles, 31, Calif. ★ 1250 W. Camden Ave., S. W., Canton, 6, Ohio
OTHER FACTORIES: San Jose 5 and Fresno 16, Calif.



...WITHOUT OVERLOADING THE MOTOR

That's the range which Morris engineers have combined in this 2-stage, double-suction, series pump.

Three distinct delivery volumes . . . three distinct heads . . . and a top head of 180 feet per impeller!

Maybe you've imagined this couldn't be done without varying the speed and horsepower of the motor. But Morris engineers have turned the trick with a skillful impeller design in a 2-stage, double-suction, series type pump, with 6" suction and 6" discharge. Originally created as a booster pump for an important United States Army water supply, its impellers are so designed that the direct-connected 100 hp., 1760 rpm. motor is not overloaded at the maximum capacity, and yet the delivery is good at the higher pressures, to wit—

500 G.P.M. at 360 ft. T.D.H.
1000 G.P.M. at 300 ft. T.D.H.
1500 G.P.M. at 140 ft. T.D.H.

By accurately proportioning the impellers to meet all three performance conditions, Morris hydraulic engineers have again proved their ability to meet the most rigorous demands of wartime use, or reliable, economical municipal operation.

MORRIS MACHINE WORKS, Baldwinsville, N. Y.

MORRIS CENTRIFUGAL PUMPS

out moving the slide. No matter where the slide is set, all figures visible in the windows of the calculator are true simultaneously.

This interesting and useful Universal Calculator, based on the Hazen-Williams formula may be obtained gratis from the Grinnell Co., 260 W. Exchange St., Providence 1, R. I.

Heavy Duty Lightweight Folding Ladder

A new type "Series G" heavy duty folding ladder in sizes from 6 to 20 ft. has been produced by the Duo-Safety Ladder Corp. of Oshkosh,

Wis. This ladder folds into a 3 by 3-in. bundle easily transported by hand. When opened a release lock holds the ladder rigid. Built extra light and safe, this new ladder has found use in many industries. As shown in the illustration this ladder has many advantages, and is ready for immediate delivery. Information on this new piece of equipment may be obtained from the Duo-Safety Ladder Corp., Oshkosh, Wis.

New Continuous Gas Analyzer-Recorder

A new 4-point Gas Analyzer provides simultaneous analysis and continuous graphic record of the amounts of any one or all of the following: Oxygen, Carbon Dioxide, Carbon Monoxide and Hydrogen.

Chemicals, fragile glassware, and moving parts in the new unit are eliminated, and the complete analyzer operates directly from the alternating current supply line. The recorder may be located at any required distance from the sampling point and the instrument can be furnished with contacts for operating warning signals or to actuate various control circuits.

In theory the instrument accomplishes analysis by direct compari-

son of thermal-conductivity of the sample with that of a reference gas, or by comparison of thermal-conductivity of the sample before and after chemical absorption or combustion.

A continuous record of the analysis is provided on a 10-inch strip chart, and the four different registrations (one for each gas) are shown by different colors and numbers on the chart.

The 4-Point Gas Analyzer is a development of the Cambridge Instrument Company, Inc., 3732 Grand Central Terminal, New York City.

Line of "AERO-SEAL" Hose Clamps Extended

The AERO-SEAL line of hose clamps, manufactured by Aircraft Standard Parts Co., now covers, in 16 models, all sizes of standard hose from ¼" inside diameter up to 4".

Most recent additions are models M-6 and M-10 for hose sizes from ¼" to ¾" inclusive. The M-6 is designed for ¼", ⅜", and ½" hose and the M-10 for ⅝" and ¾" hose.

This feature of long take-up gives all Aero-Seal Clamps a wide clamping range. The band is a spring steel strip perforated to correspond with the teeth of a worm gear. The clamp may be taken up a full inch (in the larger sizes) on diameter. This feature will be found valuable where some sizes of clamps may be missing from stock.

A circular, available from the Aircraft Standards Parts Co., 1711 19th Ave., Rockford, Ill., gives full data on the complete line of Aero-Seal Hose Clamps.

Seven "E" Awards

Is An Enviable Record

The Chicago Bridge and Iron Co. has received its seventh Army-Navy "E" award. In accepting the award, George T. Horton, president of the company, and son of the founder, announced that the company now

NO one has, as yet, been able to make an explosive or a gasoline substitute out of sewage sludge, but it has a vital place in the war effort nevertheless.

America's food production presents one of the gravest problems of the present and future. In addition to the food needs of our armed forces and civilian population, ever-increasing millions of people in many lands are looking to America for their daily bread. Greater food production means more fertilizer. Every source must be utilized, including sewage sludge which is rich in fertilizing values for the growing of food crops. Burying or incinerating sludge is equivalent to wasting food.

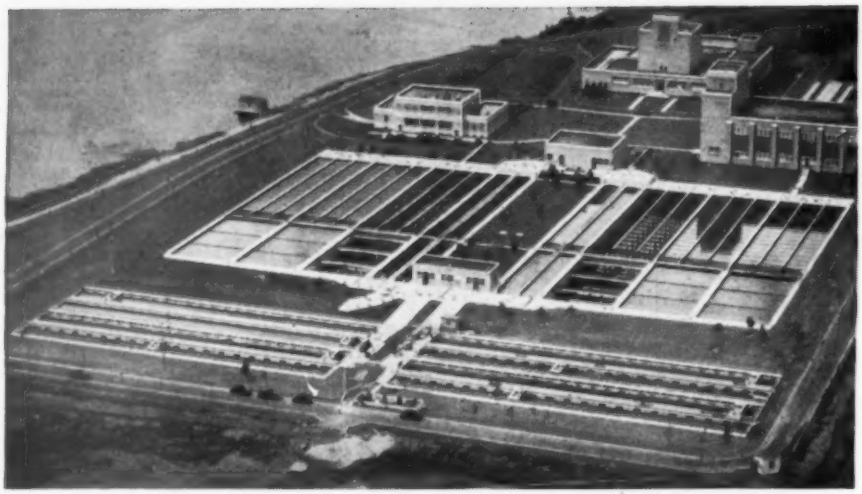
Hundreds of sewage plants are converting the sludge cake as it comes from the drying beds, into valuable fertilizer, with the Royer Sewage Sludge Disintegrator. They sell it at a worthwhile profit, making it available to Victory gardeners or use it on local park lawns. Truck gardeners and florists value it highly.

The Royer thoroughly shreds, mixes, aerates and further dries the sludge; eliminating trash at the same time. It discharges onto pile or truck an excellent fertilizer, ready-to-use. Chemicals can be mixed with the sludge in the machine to make a high strength fertilizer.

Over 6,000 Royers are in use. There's a model for every sewage treatment plant.

Write for free "Sewage Sludge Utilization Datalog"

THE ROYER FOUNDRY & MACHINE CO.
170 PRINGLE ST., KINGSTON, PA.
PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE



RECTANGULAR TANK EFFICIENCY PROVED

in the world's largest chemical treatment plant

Here, in the Minneapolis-St. Paul sewage treatment plant, the 6th year of operation once again has proved the superiority of the rectangular settling tank . . . and of REX Conveyor Sludge Collectors.

Quoting from the Tenth Annual Report . . . "the settling tanks continued to operate very satisfactorily . . . with an *average detention period of only 0.9 hour* as compared with a possible detention period of about 3.0 hours . . . average removal of suspended solids by the settling tanks was 64.3% and of the five-day B.O.D. 40.1%" . . . "a determined effort is made to secure as concentrated a sludge as possible. That such efforts have been successful is shown by the fact that, for the entire year, solids concentration in the raw sludge pumped from the settling tanks averaged 8.61% . . ."

The rectangular primary settling tanks, all equipped with REX Conveyor Sludge Collectors, comprise 6 tanks 56 ft. wide and 4 tanks 17 ft. 9 in. wide, all 290 ft. long by 15 ft. 6 in. deep. The remarkable removals shown in the table below are a tribute to the intelligent operation by the plant engineers . . . and to sound design. The efficient operation of the REX Conveyor Sludge Collectors played an important part in this outstanding performance.

REX Sanitary Engineers are always at your service. Write Chain Belt Company, 1610 West Bruce St., Milwaukee 4, Wis.

SUMMARY OF 1942 OPERATING DATA

MONTH	DET. PERIOD	% SS REM	% BOD REM
January	1.8	75.2	38.9
February	1.0	63.4	34.9
March	0.9	58.0	30.5
April	0.8	51.1	30.1
May	0.8	60.9	38.5
June	0.9	62.6	43.6
July	1.0	75.1	50.1
August	1.0	74.3	50.5
September	0.7	60.3	42.3
October	0.8	58.9	41.0
November	0.8	64.6	40.9
December	0.9	67.1	40.0
Ave. 1942	0.9	64.3	40.1

REX **SANITATION EQUIPMENT**

Triturators • Bar Screens • Tow-Bro Sludge Removers • Slo-Mixers
Aero-Filters • Rapid Mixers • Grit and Sludge Collectors and Grit Washers

CHAIN BELT COMPANY OF MILWAUKEE

Member of the Water and Sewage Works Manufacturers Association, Inc.

had a batting average of 1000 per cent; each of the company's seven operating units—three plants, three dry dock yards, and a shipyard has received the award.

The Chicago Bridge and Iron Co., founded in 1889, first dealt in the construction of iron and steel bridges. In the early 1890's the organization started building elevated water tanks and flat bottom water storage tanks.

World War II activities include many installations of water tanks at training camps, steel pipe and toluene tanks at munition plants, and Hortonspheres at synthetic rubber, aviation gasoline and chemical plants. The larger portion of the company's activities, however, are devoted to the construction of special work for the Navy, including several types of steel floating dry docks and a major schedule of LSTs. The company shipyard at Seneca, Ill., which is devoted to the construction of LSTs exclusively is the lead yard in the LST program.

The last two "E" awards were received by the company in July, one for the Chicago, Ill., plant and the other for the Greenville, Pa., plant.

More Army-Navy Awards

Among the recent recipients of the Army-Navy "E" Award is the Worthington-Gamon Meter Company, Newark, N. J., for their "outstanding production of 75 mm. shell fuses."

The Maritime "M" has been awarded to the Kennedy Valve Co. of Elmira, N. Y., for work in connection with the production of the Victory Fleet.

Stars added to "E" Award pennants signify an additional six months of outstanding production performance. Among those companies which have recently received these additional awards have been

EDSON
DIAPHRAGM PUMPS

Hand Sizes 2", 2½", 3", 4"
Power Sizes 3" and 4"
Open Discharge or Force Pump
Edson Special Suction Hose
Red Seal Diaphragms
Strainers and Foot Valves
Hose Spanners—Adapters

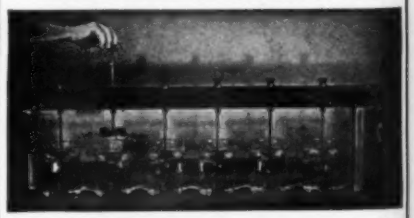
THE EDSON CORPORATION
Main Office and Works: 49 D St. South Boston, Mass.
New York: 142 Ashland Pl., Brooklyn

IMPROVED JOINTING COMPOUND
Tegul-MINERALEAD
for Bell & Spigot Main

- Sulphur base; quick sealing, speeding laying and backfilling.
- 10 lb. ingot form, easily handled, stored and shipped. Impervious to rain. Cannot change composition.
- Makes permanently tight joints. Goes 3 to 5 times as far as lead, helping conserve a strategic war metal.
- For money-saving information, write

The ATLAS MINERAL Products Company of Pa.
Mertztown Pennsylvania

THE *Phipps & Bird*
LABORATORY MIXER . . .



IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC. Richmond, Va.

the DeLaval Steam Turbine Co., Trenton, N. J., its fourth gold star; the Homestead Valve Mfg. Co., of Coraopolis, Pa., its third gold star to its "M" pennant; Builders Iron Foundry, Providence, R. I., its third star; Hooker Electrochemical Co., Niagara Falls, N. Y., its third star; Foxboro Co., Foxboro, Mass., its second star; and the Cochrane Corp., Philadelphia, Pa., its first star.

Hill Hubbell Makes Bowen V. P. and Morain Mgr. of Production

Mr. Milton M. Bowen, of Chicago, Illinois has been appointed Vice-President of General Paint Corporation and Manager of the Eastern Division in charge of Pipe Wrapping. Mr. Bowen was previously Special Representative of the Hill Hubbell and Co. and has been with them since 1936. He is thoroughly experienced in all phases of pipe wrapping and has made valuable contacts during his sales career. Beginning August 10, Mr. Bowen will make his headquarters at the Cleveland office of the Hill Hubbell Div. at 3091 Mayfield Road, Cleveland 18, Ohio.

Mr. Jack Morain, formerly General Superintendent, has been promoted to Production Manager in Charge of Operations. Mr. Morain has been with the company since 1926 and is responsible for a great deal of the design and development of our equipment.

The office in Cleveland will be in charge of Miss Frances Tuhey, who has served in various capacities since 1936 and who has been promoted to Assistant to the Division Manager.

"Gene" Brisbane Back in Circulation

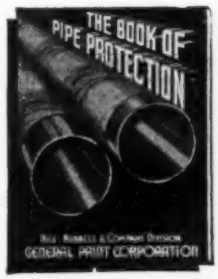
We mean back in water-works circulation, because ever since Eugene Brisbane disappeared from this field two years ago to go into strictly war production as Brisbane & Co. of South Gate, California, he has

"Gene" Brisbane

The Open Door

An open door shows the trust and confidence of those who dwell within.

Business founded on open, honest dealing, reflects the warm, friendly welcome of the open door.



Write today for your copy of "THE BOOK OF PIPE PROTECTION" which describes our process in detail.

HILL-HUBBELL
THE HOUSE OF GOOD STEEL PIPE PROTECTION

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. • Division • Cleveland, Ohio
• EXPORT OFFICE: SAN FRANCISCO, CALIFORNIA, U. S. A. •

AMERICAN GAS BOILERS
STEAM AND WATER TYPES
FOR **DIGESTER HEATING**
SEE DATA PAGE IN ANNUAL REFERENCE SECTION

AMERICAN RADIATOR & Standard Sanitary
New York CORPORATION *Pittsburgh*
SALES OFFICES IN ALL PRINCIPAL CITIES

SMITH

TAPPING SLEEVES

THE A.P. SMITH MFG. CO. EAST ORANGE, N.J.

Symbol of Quality Since 1889

MAKING PRESSURE CONNECTIONS *Without Stopping the Service*

SMITH Tapping Sleeves for making pressure connections to A.W.W.A. standard mains, classes A, B and C, and for pressures up to 150 lbs. per square inch, are made in four types, here illustrated. At top: 1. Clamped Sleeve Joint; 2. Bolted Sleeve Joint. Bottom row: 3. Bolted Sleeve Joint with flanged end joint valve connection; 4 Hackensack Sleeve Joint with flanged end joint valve connection.

OTHER SMITH PRODUCTS
Valves and Hydrants — Valve Inserting Machines — Tapping Sleeves — Tapping Valves — Flanges and Water Meters
Write for Catalog

A. P. SMITH TAPPING SLEEVES

Branches
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409 Texas St., El Paso, Texas
315 N. Crescent St., Flandreau, S. D.
1221 Mortgage Guarantee Bldg., Atlanta, Ga.
428 13th St., Oakland 12, Calif.
524 First Ave. S., Seattle, Wash.
1317 Oakley St., Orlando, Fla.

THE A. P. SMITH MFG. CO., EAST ORANGE, N. J.

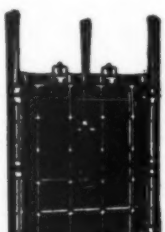
been turning out mostly secret marine equipment for Uncle Sam, with 150 loyal workers averaging 54 working hours per week and boasting a record of 0.04 of absenteeism.

At the Milwaukee Convention of A.W.W.A. "Gene" Brisbane turned up with an exhibit of considerable interest from Brisbane & Co., and a promise that much that is novel in water and sewage works equipment is to come out of Brisbane & Co. following the war, if not sooner —reconversion controlling.

If the novel variable flow "Briscoe" Pump demonstrated at Milwaukee is any indication of what's to follow in the line of promised Automatic Controls, Hydraulic Valves and the like—just keep your eye on Brisbane of South Gate.

Many of our readers will remember "Gene" Brisbane's successful connection with the development and marketing of cone type valves, and his tenure with S. Morgan Smith of York, Pa. Now the war has put him on his own, and much is to be expected from Brisbane & Co. as soon as we put the finishing touches to Messrs. Hitler, Tojo and their ilk.

RODNEY HUNT



GATES and HOISTS

Metal or timber sluice gates of all sizes and designs, approved by engineers everywhere. Improved gate stands and hoists for hand or motor operation. Also flap and mud valves, shear and filler gates, trash racks and rakes. Dependable canal equipment from dam to tail-race since 1840.

Write for Special Catalog Today!

RODNEY HUNT

RODNEY HUNT MACHINE CO.
118 Lake St., Orange, Mass., U. S. A.

SAVE MONEY USE ACTIVATED ALUM and BLACKALUM

STUART-BRUMLEY CORP.
516 North Charles St.
Baltimore Maryland

BAILEY METERS AND CONTROLLERS

FOR SEWAGE TREATMENT AND WATER SUPPLY . . .

● Venturi Tubes, Weirs, Flumes, Nozzles and other primary elements; Mechanically and Electrically operated Registers and Complete Automatic Control Systems.

BAILEY METER COMPANY
1672 IVANHOE ROAD • CLEVELAND, O.
Bailey Meter Co. Ltd., Montreal, Canada

Corbin Made Minneapolis Mgr. for Penn Salt

Among recent personnel changes in Pennsylvania Salt Mfg. Co. was the appointment of Gilbert H. Corbin, formerly Field Sales Mgr. of

G. H. Corbin

the Laundry and Dry Cleaning Div., to be District Sales Mgr. in the Minneapolis office. Mr. Corbin has been associated with the company's Laundry and Dry Cleaning Division since it was established in 1940, following the purchase of the Sterling Products Co. He had been associated with the latter company for about thirteen years.

Bristol Opens Two New Branch Offices

The Bristol Company, Waterbury 91, Conn., manufacturers of automatic control and recording instruments has opened two new branch offices. D. D. Ault, who has been resident sales engineer in Houston for a number of years will be in charge of the new office in Houston, Texas.

The other new office, the Cleveland Branch office, located in the Engineer's Building, Cleveland 14, Ohio, will serve the states of Kentucky and Ohio with the exception of the Toledo area. G. H. Gaites will be Regional Sales Supervisor of the Cleveland and Pittsburgh territories.

Link-Belt Opens Warehouse and Office in Spokane

Announcement has been made that the Link-Belt Co. Pacific Div. has opened a sales office and warehouse in Spokane, Wash., with Mr. Homer A. Garland in charge. Eastern Washington, northern Idaho, and the western portion of Montana will be served by the new warehouse located at South 151 Lincoln St., Spokane 8,

Fight CORROSION with ☆ REILLY PAINTS

LONGER LIFE AND LOWER MAINTENANCE COST For Tanks

☆ Reilly Paint on the exterior of your storage tank will give dependable protection against corrosion. This tough, durable, corrosion-fighting coating adds years of life to tanks and other exposed metal construction, and keeps maintenance costs down.

As an inner lining on storage tanks, Reilly Enamel gives the protection required. Reilly Enamel is used both as an outside coating and inner lining on steel water lines, protecting them from corrosion, tuberculation and incrustations and assuring full capacity flow for the life of the pipe. Booklet describing REILLY Protective Coatings will be sent on request.

Reilly COAL TAR PRODUCTS

17 PLANTS To Serve the NATION

REILLY TAR & CHEMICAL CORPORATION
Merchants Bank Bldg., Indianapolis 4, Indiana
500 Fifth Ave., New York 18, N. Y. • 2513 S. Damen Ave., Chicago 8, Ill.

..for ACCURACY and TROUBLE-FREE OPERATION
INSIST ON THE WILSON PULSAFEEDER

Engineered and Manufactured by
WILSON
CHEMICAL FEEDERS, INC.
203 CLINTON STREET AD KE-1 BUFFALO 4, N. Y.

ANTHRAFILT
A Filter Medium For All Purposes
ANTHRACITE EQUIPMENT CORP.
101 Park Ave. New York
H. G. Turner Research Engineer
STATE COLLEGE, PA.

EDDY

FIRE HYDRANTS AND VALVES—

WATER WORKS EQUIPMENT

EDDY VALVES
For
Water Works
and
Sewage Disposal
Plants

EDDY FIRE HYDRANTS
For Fire Protection Service

Write for Complete Catalog

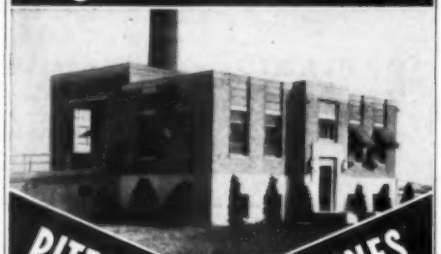
Eddy
VALVE COMPANY
WATERFORD, N. Y.

Wash. Mr. Garland, a native of Manistique, has been associated with the Link-Belt organization since 1922 in the area around Spokane.

Westinghouse Appoints McKibbin to New Post

Westinghouse Electric and Manufacturing Co. has announced the appointment of John M. McKibbin as assistant to the vice president. Formerly manager of the Company's Application Data & Training Department, Mr. McKibbin's new re-

℞ for POST-WAR PLANNING



PITTSBURGH · DES MOINES

INCINERATION PLANTS

Smooth the path to community post-war employment and improvements, by blueprinting your refuse disposal requirements *now*—with the able technical assistance of Pittsburgh-Des Moines engineers. Meantime, write for bulletin No. 601.

PITTSBURGH · DES MOINES STEEL COMPANY

Pittsburgh, Pa. . . . 3418 Neville Island
Des Moines, Ia. . . . 919 Tuttle Street

GOOD Tasting Water Keeps The Public Happy

HYDRODARCO

And you can depend on Hydrodarco to deliver just that: Good Tasting Water —because tests prove that this activated carbon produces real results at moderate cost.

Hydrodarco: Reg. U. S. Pat. Off.

DARCO CORPORATION

60 East 42nd Street, New York 17, N. Y.

Distributing Points: New York, Cincinnati, St. Louis, Buffalo, Chicago, Kansas City, San Francisco, Los Angeles, Marshall, Tex.

sponsibility will include all product and industry advertising, in addition to his present duties.

A native of Pittsburgh, Mr. McKibbin joined Westinghouse in 1922 as a member of the promotion division in Pittsburgh. Two years later he was made advertising manager of the Company's Cleveland office. This was followed by appointment as advertising manager of the Detroit office, then in charge of the industrial areas of Ohio, Penn., Mich., Ky. and West Va. Later his offices were moved to East Pittsburgh where he supervised promotional operations. In 1936 he was named apparatus promotion manager to coordinate all such activities, except those involving Westinghouse merchandising equipment, at headquarters and in district offices. He remained in this position until 1937 when he was appointed head of the Application Data & Training Department.

LITERATURE AND CATALOGS

Propeloflo Meter, Bulletin 350 of Builders-Providence Co., Providence, R. I., describes the new propeller type totalizing meter of that company. Included in this four page bulletin are a short description, applications, characteristics, materials of construction and blue prints of different models with a table of dimensions for different size meters. This new meter has a direct reading totalizer and recorder, it is of Venturi design and is self-contained and complete in itself. A saddle type meter is also available, as is a line screen for protection of the meters. Bull. 350 is obtainable from Builders-Providence, Providence 1, R. I.

Steel Pipe for underground water lines is the National Tube Co. Bulletin No. 21 containing engineering data and information on the use of steel pipe. The 80-page bulletin is amply illustrated with photographs of many installations. There are sections devoted to the discussion of the General Features of Steel Pipe, Bureau of Standards Soil Corrosion Investigation, Mechanical Features, Installation Features, and the A. P. I. Tentative Code of Good Practice.

The Technical section contains sections devoted to Specifications, Internal Fluid Pressures, Properties of Water, Water Pressure, Flow

DEPENDABILITY
24 HOURS A DAY

JOHNSON *Right-Angle*
PUMP DRIVE

★ SEWAGE ★ WATER WORKS ★
FIRE FIGHTING ★ FLOOD CONTROL

The Johnson Right-Angle Gear Drive is used as a "connecting unit" between the pump and the power unit. Illustration shows a combination application. These drives are manufactured in a variety of types and sizes, each designed to meet the specifications of a wide range of applications—Sewage Disposal; Water Supply; Fire Fighting; Flood Control; etc.

★ EFFICIENT ★ DEPENDABLE
★ ECONOMICAL ★ COMPACT
★ FULLY ENCLOSED ★ LONG LIFE

The Johnson Right-Angle Gear Drive is sold through Pump and Engine Manufacturers—their local representative will explain the many advantages of this drive which is used by scores of municipalities. Write for Catalog No. 12.

JOHNSON GEAR
& MANUFACTURING CO., LTD.
MAIN OFFICE AND WORKS: BERKELEY, CALIFORNIA

ZECO
GREENSAND
ZEOLITE

ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.

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Sales Office: 140 Cedar St., New York, N.Y.
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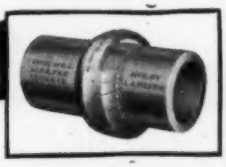

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of Water, Measurement of Flowing Water, Water Power, Convenient Equivalents, Physical Properties, and Weights and Dimensions. Bulletin No. 21 is well worth requesting from the National Tube Co., Pittsburgh, Pa.

Simplex W-K Principle and Type MO Meter for measuring flow through turbines is presented in Bulletin 420 of the Simplex Valve and Meter Co. of Philadelphia. This six-page bulletin gives installation details with diagrams and discusses the W-K principle and differential taps, and the MO Type Meter. Representative installations are also listed. The bulletin containing this information is No. 420 and may be obtained from the Simplex Valve and Meter Co., 68th and Upland Streets, Philadelphia 42, Pa.

Chemco Chlorinators—Ammonators and Water Conditioning Equipment are presented in brief in a pocket size folder bulletin of the Chemical Equipment Co. of Los Angeles. Pictures and short descriptions are given for the following types of equipment: three different vacuum type solution feed chlorinators, the type TC dry feed

HAVE YOU INVESTIGATED—

the proved advantages of Roots-Connersville Rotary Positive Blowers for supplying air to your sewage treatment tanks? The records of hundreds of municipal installations—large and small—all over the country testify to the economical and trouble-free performance of "R-C" Aerating Blowers. They stay on the job—many have been in constant use 25 years and longer. Write for Bulletin 23-B-12.

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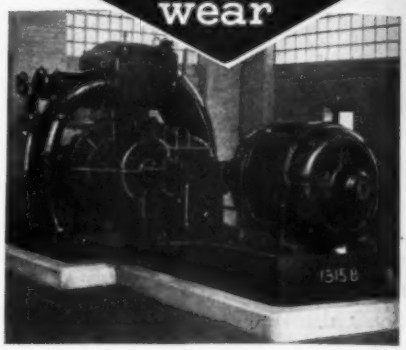

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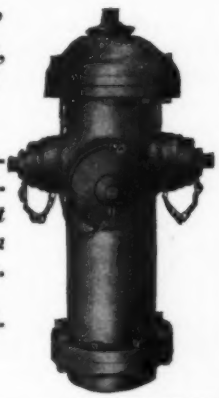

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Precision Bore Glass Tubing, Catalog 95-A of Fischer & Porter Co., the first one on "Glo-Tech," tells the story of the development of this method of making glass tubing with tolerances of ±0.0002-in. Many specimens of "Glo-Tech" tubing of all shapes and sizes are shown including tubing for high accuracy manometers, barometers, visconeers, and other scientific instruments, as well as many examples of precision bore glass specialties. Sizes from 0.013 to 6-in. I.D. are available. Catalog 95-A will be sent on request to Fischer & Porter Co., 000 County Line Road, Hatboro, Pa.

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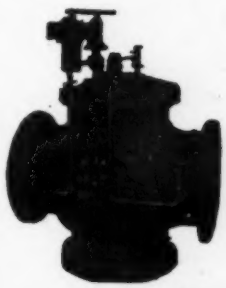

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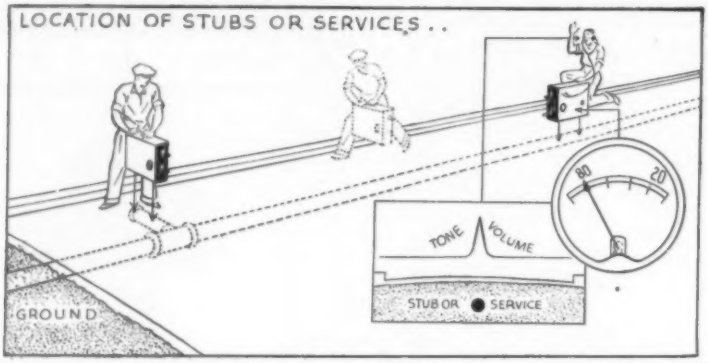

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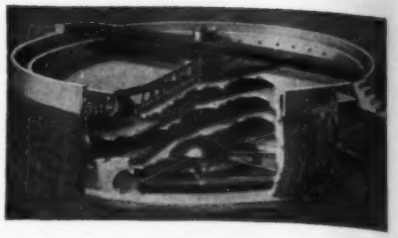

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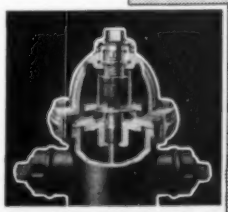

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Hendrick Wedge-Slot Screen is a four page bulletin of the Hendrick Manuf. Co., Carbondale, Pa. These screens, made in one of three profiles, curved or straight, have full length slots, high carrying strength of wedge slot bars, and may be used for wet or dry screening. This type of wedge-slot screen is applicable in water cleaning, water filtration under gravel or sand beds, sewage screens of disc type, coarse sewage screens and industrial waste treatment. Different bar sizes are available. For this bulletin or further information write the Hendrick Manufacturing Co., Carbondale, Penna.

Piping Pointers is a 32-page bulletin issued by Crane Co. of Chicago. It is a bulletin every water works and sewage plant operator will want. It is full of explanatory diagrams and understandable advice on how to make up a screwed joint, a flanged joint, or a soldered joint, how to install globe valves, information on the language of piping, valve designs, and how they operate. Also included is information on the range of pipe fittings, hints on handling valves, fittings, and pipe, why valves leak, and planning a job with precision. Write for your copy of Piping Pointers to Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.

"Cast Iron Pipe News" for April 1944 contains an interesting article on "Prevention of Water System Repair Jobs" by Dewey W. Johnson. Included are two charts showing the retirement curves for cast iron pipe of different sizes, as well as charts showing trench load, truck load plus impact, and methods of pipe laying and values. The article covers a number of precautions that should be taken in laying pipe in different types of soil and other pertinent information of considerable value.

This issue also contains an article on the use of C. I. pipe and fittings in a synthetic rubber plant, a story of friction flow tests on 48 miles of C. I. pipe at Corpus Christi, Texas, and another story on the installation of 945 feet of C. I. pipe in a river crossing at DePere, Wis.

Silicate P's and Q's, the monthly one page issue from the Philadelphia Quartz Co., of Philadelphia tells of a new application of silicate of soda. In short it has been found how to make porous or shifting sandy soil into a rock like bearing soil. A process known as the Joosten process after its inventor, Hugo Joosten, a Dutch mining engineer is described.

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"GUNITE" CONTRACTORS
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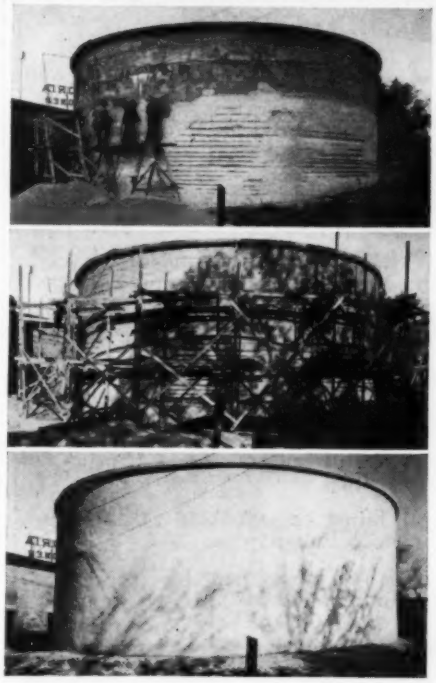

"GUNITED" 12 YRS. AGO —STILL SATISFACTORY

The upper photograph shows the badly disintegrated condition of a large old reinforced concrete tank at Alexandria, Minnesota,—note how the reinforcing steel was exposed by the elements. In the middle picture the old surface is being chipped and sandblasted and the new reinforcing mesh being applied. At the bottom is the completed job, finished with white cement, after a coating of "GUNITE" had been applied. The interior of this tank was also lined with "GUNITE." We did this work in 1932 and now, after more than a decade, no deterioration is in evidence.

Our Bulletin 2200 describes many similar jobs and numerous other applications of "GUNITE." Ask us for a copy!

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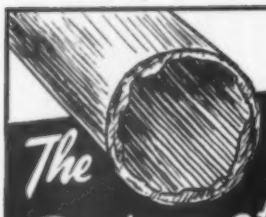

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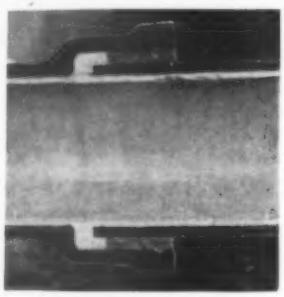
Now is the time to investigate the Tate Cement Lining process —and see what it can do to restore the efficiency of your old water mains.



View showing Tate Process in Pipe Joint. Note thoroughness of Lining.

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By proper manipulation, masses similar to medium hard limestone are obtained by the action. Crushing strength is surprisingly high. This process has been used in the Chicago freight tunnel to seal off a hydrostatic head of 30 ft. It has also been used to consolidate the subsoil under heavy machinery in a plant in Florida. Perhaps the application of this process will mean the elimination of problems of soft earth tunnel work in the construction of large sewers and storm drains.

Worthington Regenerative Turbine Pumps for general water service, cooling tower service, small boiler feed service, sanitary drinking water supply, and other service, are presented in Bull. W-324-B2 of the Worthington Pump and Machinery Co., Harrison, N. J. In addition to rating tables and dimension tables, the bulletin contains cut-away drawings illustrating the pumps. "Features which mean superior performance over a longer life" include these: High head per stage, one stuffing box, renewable clearances, self-priming, hydraulically balanced impeller, low cost, and low power consumption, among others. Bulletin W-324-B2 may be obtained by writing the Worthington Pump and Machinery Co., Harrison, N. J.

The ABC of pH Control in its 12th edition has just been issued by the LaMotte Chemical Products Co., Baltimore, Md., in celebration of its 25th anniversary.

This attractive manual has been revised and enlarged to 84 pages to become the most comprehensive handbook yet published by the "Originators of Practical Application of pH Control."

The book also contains a general catalog section describing the full line of LaMotte equipment and chemical reagents of interest in the process industries; analysis of water, sewage, and industrial wastes; boiler feed water; electro-plating; soil testing; and other fields requiring specialized controls. The book may be obtained by writing the LaMotte Chem. Prod. Co., Towson 4, Baltimore, Md.

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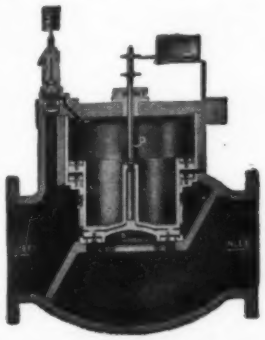

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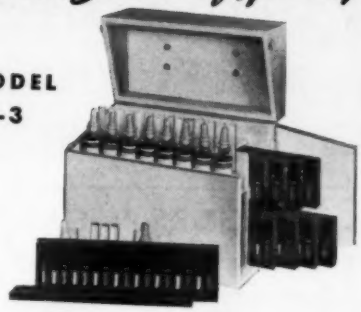

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. . . for water purification and sewerage plants. Portable outfit contains durable, non-warping plastic base and 3 color standard slides—chlorphenol red, bromthymol blue and phenol red (pH 5.2 — 8.4). Range can be expanded (0.2 — 13.6) by addition of extra slides.

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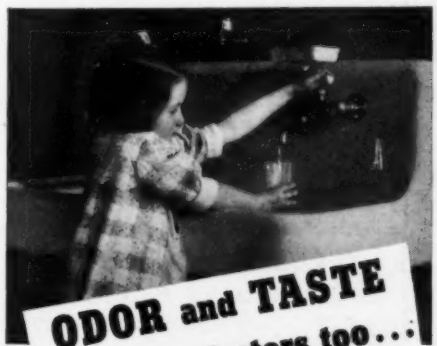

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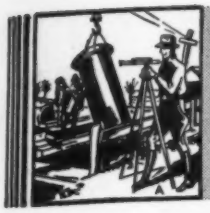

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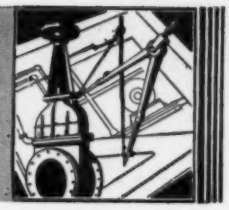

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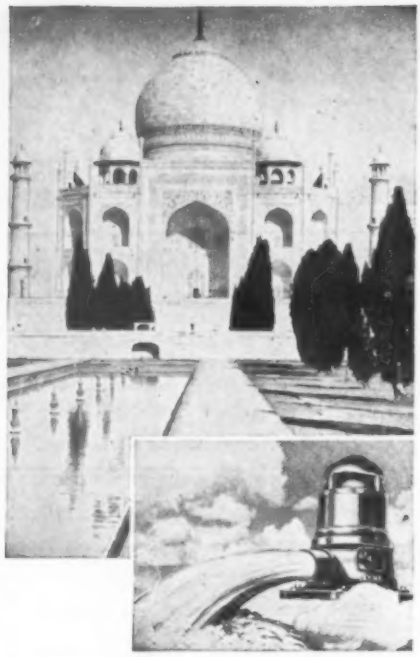

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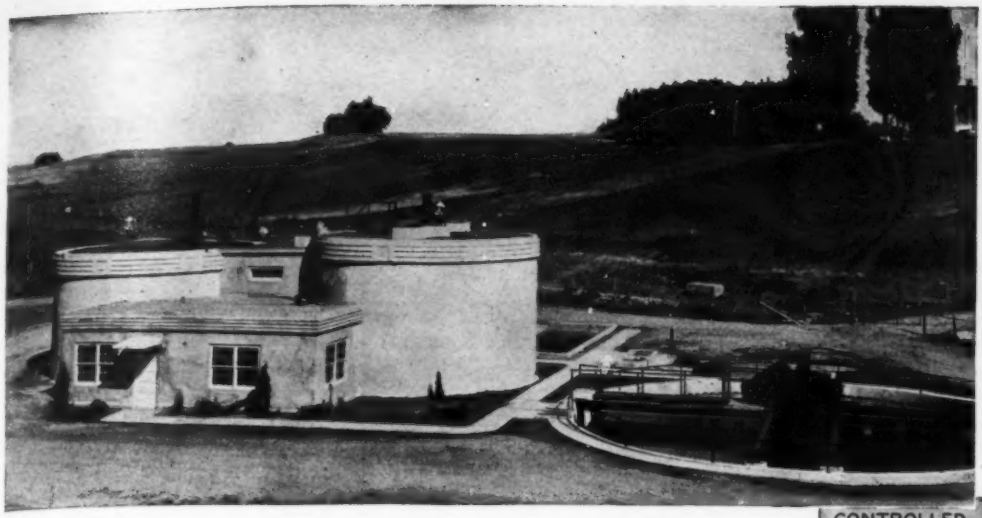

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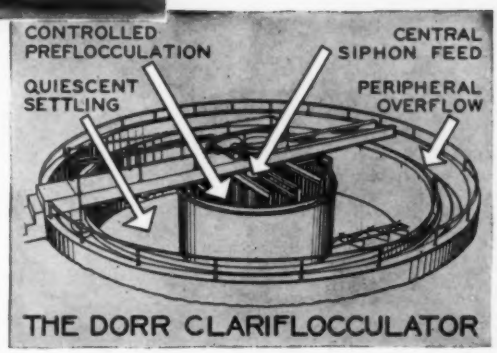

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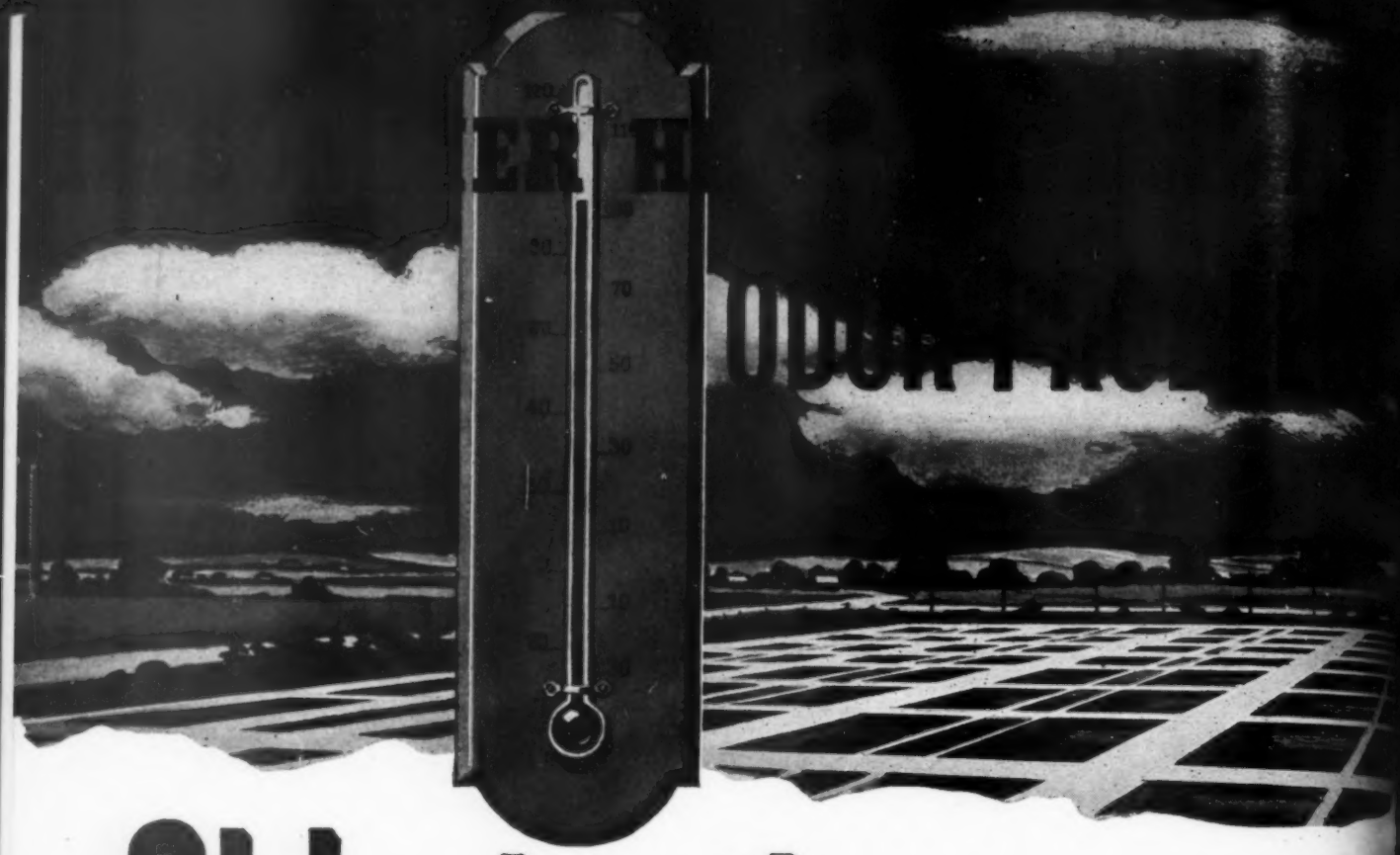

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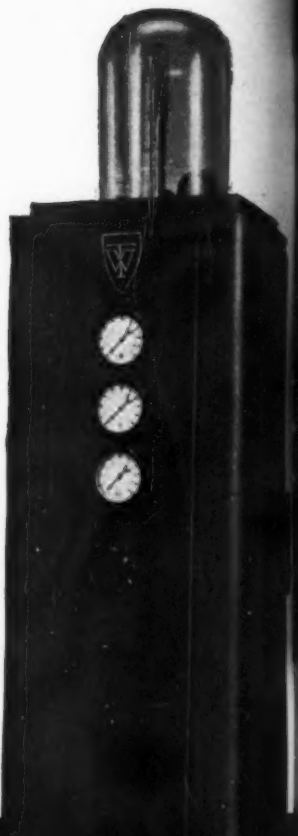

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